Strategic Trends in Intermodal Logistics & Rail Modernization

Implications for Technology Scouting & Capability Development

YLTER

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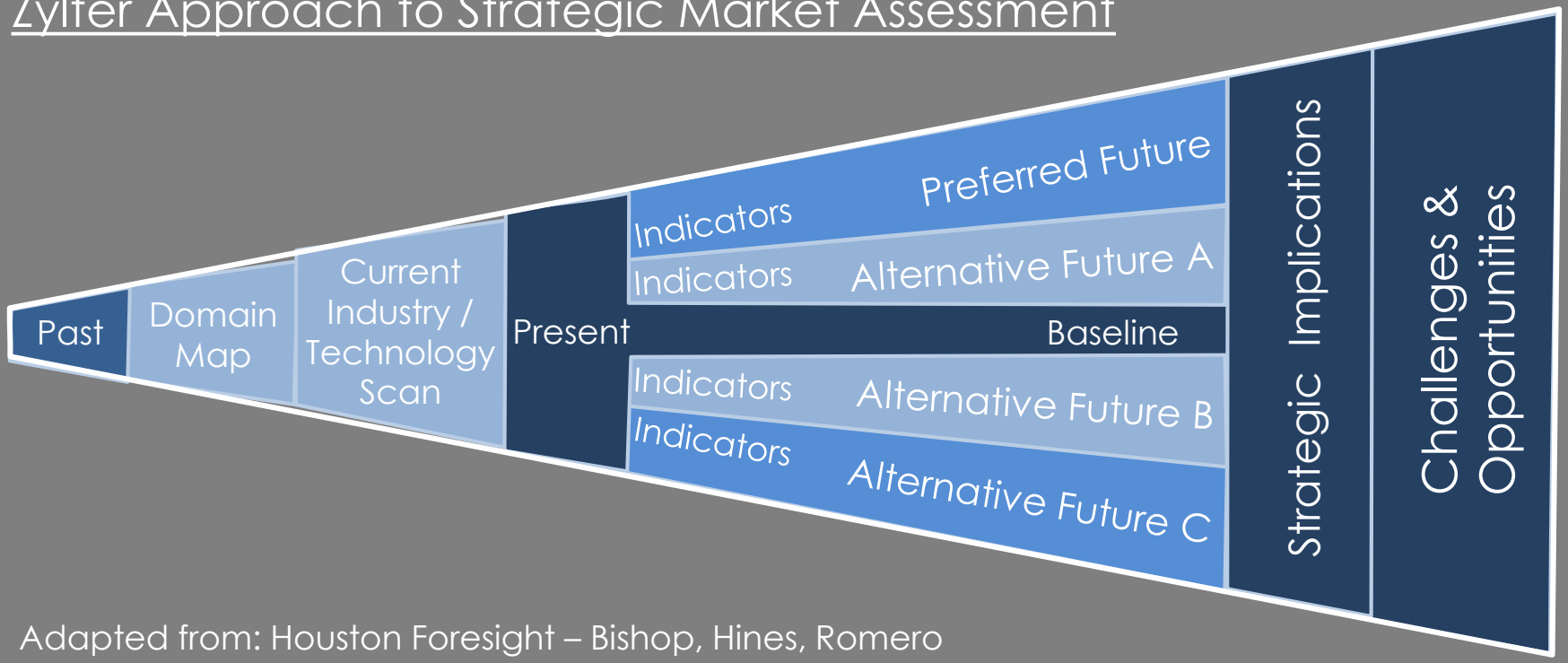
Zylter and our commercial partners are seeing four major trends in logistics tech adoption

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

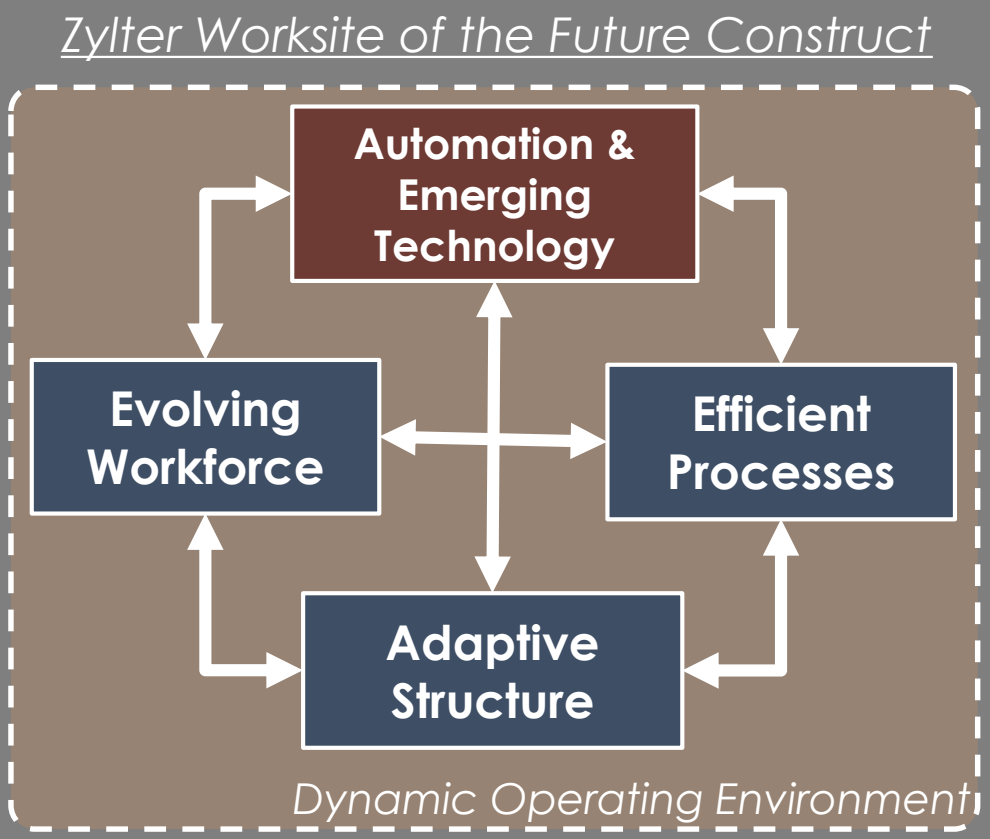


Adapted from: Houston Foresight – Bishop, Hines, Romero

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
Increasing Unitization Of Shipments	▪ More adaptive and coordinated tracking, categorization, and break bulk capabilities
Increasing Interest in Making Short-haul More Competitive	▪ More distribution of intermodal nodes and faster transfer between modes ▪ Increased rail efficiency and responsiveness
Increased Demand for Precise End-to-end Visibility	▪ Increased fidelity and density of tracking systems ▪ Interoperability between systems for each key supply chain actor
Aging Workforce	▪ Increasing average age of workforce presents strategic issues for negotiating and supporting new technology implementation ▪ Workforce recruitment and retention impacted by perceived organizational modernization and fluence with technology
Increased Use of Telematics and Analytics	▪ Integration of systems to capture, collect, store analyze and distribute data ▪ Continuing need to translate collected data into actionable insights for key tactical and strategic decisions

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

WORKSITE ASPECT	KEY STRATEGIC INDICATORS
AUTOMATION & EMERGING TECHNOLOGY	▪ **Maturity of Autonomous Systems:** Gantry cranes, lifts, etc. ▪ **Development of Supporting Infrastructures Required:** Physical, communications, IT, etc. ▪ **Evolution of "Smart" Railroad Components:** Connected engines ,cars, etc. ▪ **System / Data Security Threats and Capabilities:** ISPs, Blockchain, etc.
TASKS & PROCESSES	▪ **Automated Mode Transfer**: Requires automated classification, handling and tracking of cargo ▪ **In-Transit Visibility**: Need to track contents through all phases of supply chain and across modes ▪ **Safety Improvements:** Immediate and easily-defined ROI for investments
ADAPTIVE ORGANIZATIONAL STRUCTURES	▪ **Remote-/ Tele-Op Technologies:** Potential for remote execution and oversight with high-speed communications infrastructure ▪ **Role of and Impact on Organized Labor:** Impact of technology on existing agreements with Teamsters, Longshoremen, etc.
EVOLVING WORKFORCE	▪ **Technical Expertise Requirements:** Increased demand for integration and technical support expertise ▪ **System Integration Demands:** Ability to bring together multiple technologies to build a value-creating, sector-specific capability
OPERATING ENVIRONMENT	▪ **Regulation:** National and international regulation (DOT, OSHA, DHS, etc.) ▪ **Standardization Across Rail Carriers:** Level of common infrastructure and protocols for national and short line haulers

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

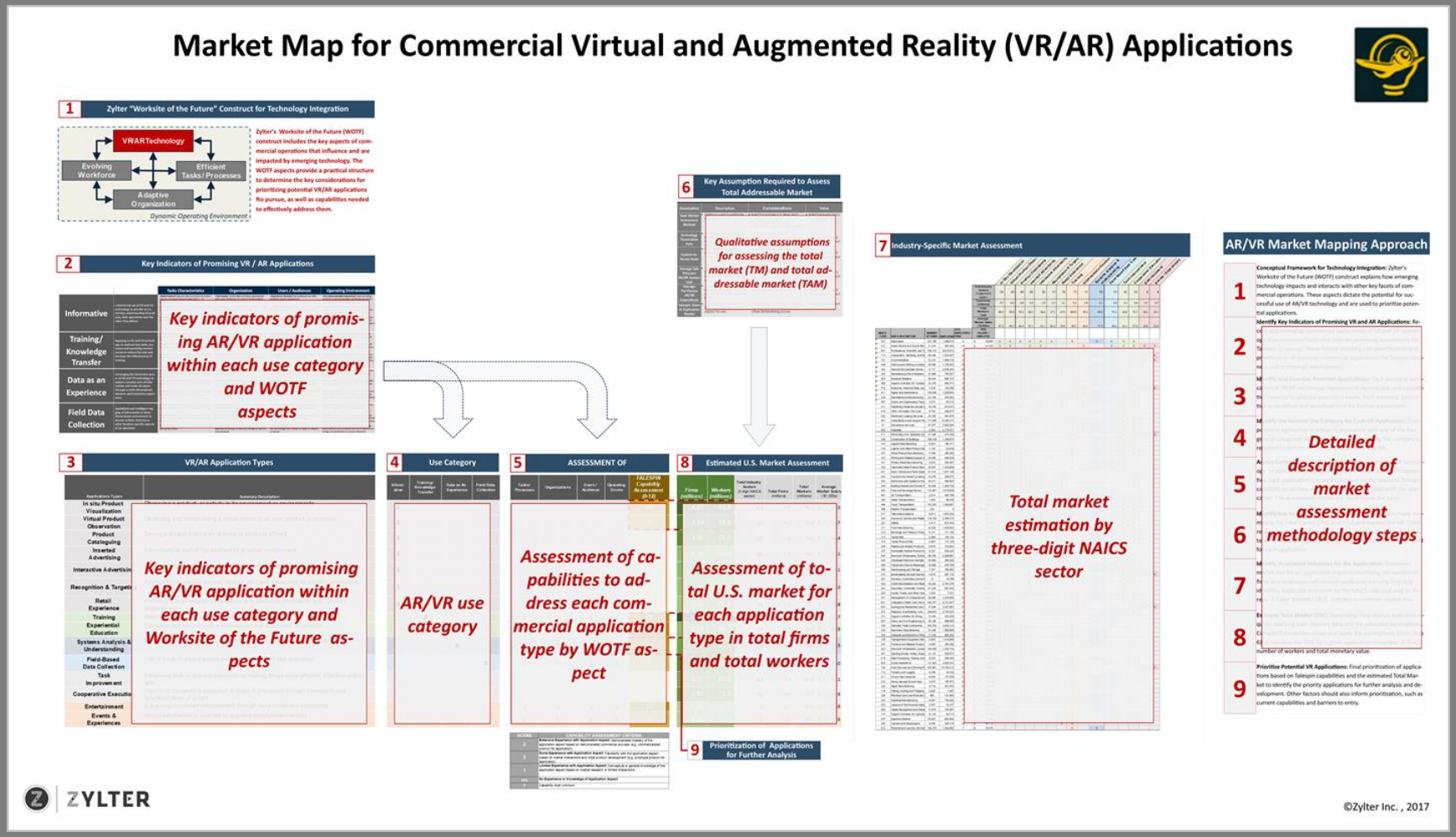
Identifying, prioritizing and developing priority opportunity areas requires a systematic and detailed approach

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
1. CORE TECHNOLOGY CREATION	▪ Initial development and integration of core technologies and system components required to address fundamental aspects of a general purpose
2. USE CASE DEVELOPMENT	▪ Assessment of the performance and cost implications of applying core technology in a specific application
3. PROOF OF CONCEPT	▪ Prototype development and field demonstration (e.g., pilot project) in a realistic operating environment to demonstrate product viability
4. FINAL PRODUCT DEVELOPMENT	▪ Final engineering and manufacturing development based on outcomes from the proof of concept to enable full production of complete product
5. PRODUCT DELIVERY & SUPPORT	▪ Introduction of the new product into the market(s) through marketing, sales and distribution

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



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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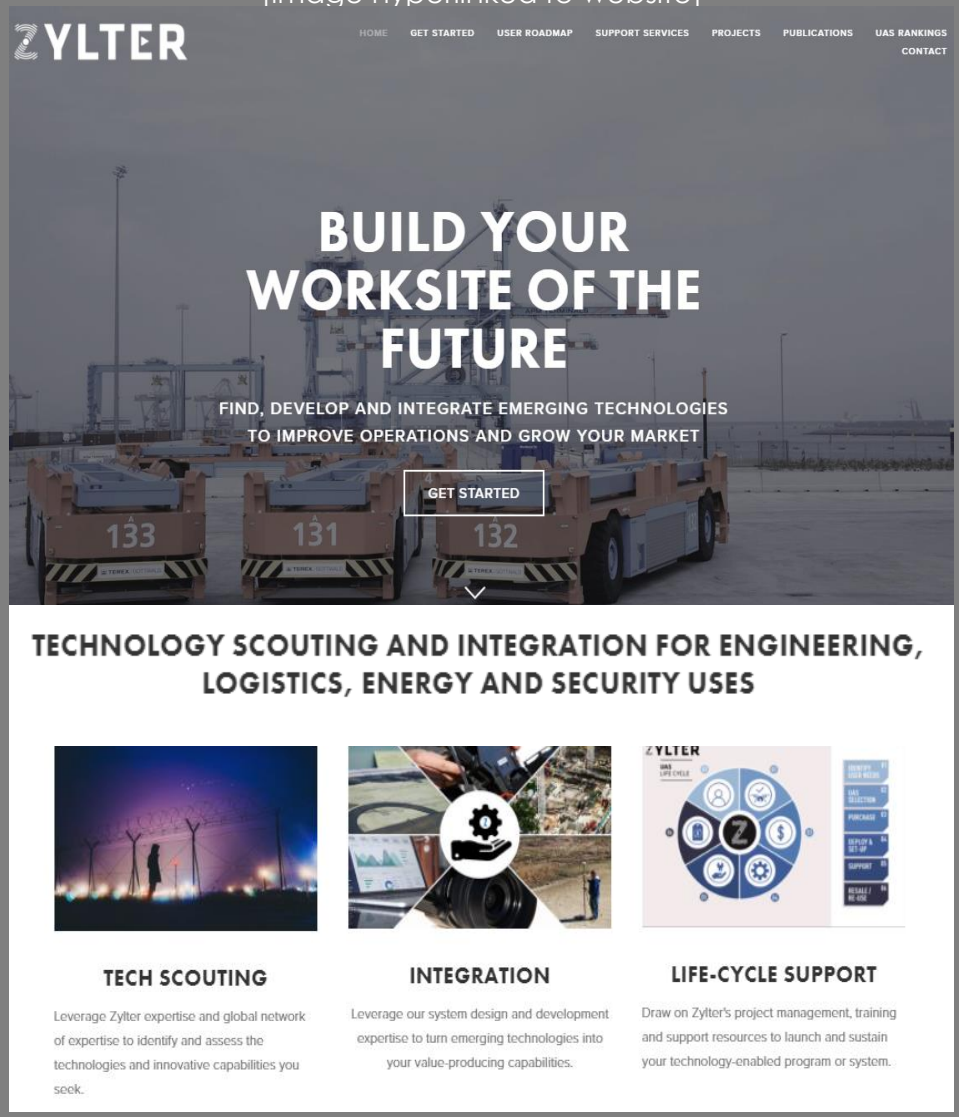


Integrate. Technology. Zylter.
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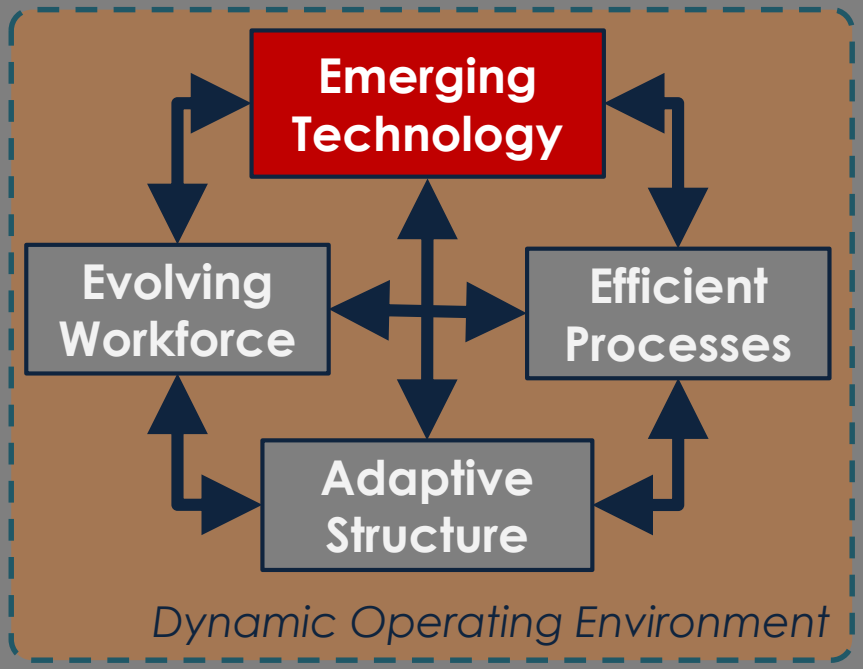
We work across a portfolio of technologies to meet commercial needs

Zylter Worksite of the Future Construct



Zylter Technology Product Areas

- Unmanned Ground Systems
- Unmanned Aerial Systems
- System Integration Software
- Info Collection, Analysis & Big Data
- Augmented / Virtual Reality (AR/VR)
- Enabling Technologies