Travel Trends Driving the Paradigm Shift of Government Travel

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Sabre Labs & Product Strategy
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Technology is rapidly reshaping both consumer + business landscapes
The biggest driver of change in the $1.6T travel business is the expectation set by non-travel experiences.
Expectations created outside of the travel experience

Travel brands are pushed to meet expectations set by non-travel brands

5B Mobile phones worldwide

35% Sales from recommendation engine

87K Drink combos

33M “versions” of Netflix

Expectation set: 24/7 mobile access

Expectation set: Personalization

Expectation set: Choice and speed

Expectation set: Winners use data well
The Big 5 trends impacting Government Travel ecosystem

- Traveler and System Security
- Travel Complexity
- Personalization
- Private Sector
- Airline Transformation
Airlines and hotels are transforming into retailers to access with new ways to drive top line revenue.

Simplifying the travel experience is critical for the future.
The number of air passengers will balloon from 4B to 7.8B by 2036.

IATA’s passenger projections. Image courtesy of IATA.
### Complexity to simplicity in travel

<table>
<thead>
<tr>
<th>Potential ways to fly from JFK to LHR in a year</th>
<th>Options for a specific day of travel</th>
<th>Options actually available for you to purchase</th>
<th>Options likely to provide the best value</th>
<th>Top options that best fit your travel plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>4, 9, 3, 2, 1, 0, 2, 2, 4, 1, 6, 3, 5</td>
<td>5, 2, 9, 3, 4, 3, 0, 7, 9, 9</td>
<td>3, 2, 2, 5, 9, 3, 7, 7, 5, 0</td>
<td>6, 1, 1, 3, 3, 8, 7</td>
<td>2, 0, 0</td>
</tr>
</tbody>
</table>
Travel Network shopping volumes

- Total TN shopping volume in 2019 was ~249 billion
- TN 2019 YoY shopping growth rate was 47%
Travel Network: Steady increase in shopping volumes

- Shopping topped 24B in December 2019
Travel Network: Total itineraries top 2.5 trillion in Q4 2019

- Itineraries returned exceeded and remained at 2.5 trillion in Q4 2019
Airline revenue mix continues to change

Average airfare decline in the past 10 years: ↓0.9% per year

Global revenue and ancillary sales per passenger boarded (PB) trends

- Total Revenue/PB: -1% CAGR
- PAX Revenue/PB: -2% CAGR
- Ancillary Revenue/PB: +38% CAGR

Sources: IATA, IdeaWorks
Travel complexity continues to increase

- Increase in travel volume & exponential air fare growth
- Opaque schedules and fares
- Air and hotel content fragmentation
- IATA’s New Distribution Capability (NDC)
- Dynamic pricing and dynamic packaging
- Payment landscape fragmentation
Airlines and Lodging are moving toward intelligent offer management.
- Right offer set
- Right customer
- Right price
- Right time.
Business travelers want convenience

Mobile
High customer expectations, low margin for error for agencies

Chat Interfaces
Natural means of user interaction with technology

Wearables
Personalization increases touchpoints with traveler

86%
Will pay more for a better digital experience

25%
Switch to a competitor after one negative experience
Personalized travel with Intelligent Retailing
Travelers → Personas → Personalization for a Segment of ONE

Intelligent Retailing

Customer Segmentation
- Unsupervised Learning
- Personas

Next Generation Shopping
- Customer Segmentation
- Ultra Fast Shopping
- Multi-month calendars
- AI/ML enabled recommendations

Dynamic Pricing
- Customer Segmentation
- Next Gen Revenue Management

Next Generation Storefront (SR360)
- Value of Ancillaries: Conjoint Survey
- Product Normalization - scoring, rating & ranking bundled offers
- Default Shelf Configuration (MAB)
- Workflow Instrumentation

Offer Management
- Customer Segmentation
- Bundle Recommender
- Multi-Armed Bandit Test & Learn
- Personalization - segment of ONE
“Smart” experiments drive intelligent recommendations for air shopping, offer management, intelligent storefront, ancillary pricing and much more...

• **Business Question:** Which option is the best alternative?

• Experiment by allocating options across requisite dimensions, (e.g., dates, day-parting, etc.)

• Use **multi-armed bandit (MAB)** technique to test the associated metrics at various alternative scenarios and continuously tune the model to focus on the best performing alternatives
SmartShop (ASE) with Multi-Calendar test-and-learn experimentation model

- Ultra-fast shopping engine
- Core Pricing of Smart Shop is 50-100x faster than any industry solution, providing a great shopping experience
- Live shopping; no cache required
- Extended calendar view (7 – 11 month)
- Destination shopping
- Single day shopping
- Context for travel based Segmentation
- Revenue-based redemptions
- 1:1 Personalization to find the “best fare” with Preference Driven Air Shopping (PDAS)
- Machine Learning / AI enabled multi-calendar display of the best fare and lowest fare for the customer segment
Offer management – selling the right airline bundle to the right customer at the right price at the right time ...

**Traditional segmentation**

<table>
<thead>
<tr>
<th>Price</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y $1000</td>
<td>10</td>
</tr>
<tr>
<td>M $700</td>
<td>5</td>
</tr>
<tr>
<td>B $500</td>
<td>10</td>
</tr>
<tr>
<td>D $300</td>
<td>15</td>
</tr>
<tr>
<td>V $200</td>
<td>20</td>
</tr>
</tbody>
</table>

**Context-based segmentation**

- **Business**
  - Short haul
  - Medium haul
  - Long haul
  - Advance purchase
- **Leisure**
  - Length of stay
  - Number in party
- **Couple**
  - Channel
  - Weekend stay
- **Family**
  - Departure day
  - Return day

**Travel extras**

- Baggage
- Seats
- Meals
- Drinks
- Car rental

**Personalization**

**Segment of ONE**

**Declared Customer**

**Customer Profile**

**Entitlements**
A persona-based recommendation engine to maximize conversion rates of the air bundle – airline view

Recommendation Engine
Recommends bundles based on travel context

<table>
<thead>
<tr>
<th>Lounge access</th>
<th>Cabin upgrades</th>
<th>Standby allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free drinks</td>
<td>Extra leg room</td>
<td>Meal</td>
</tr>
</tbody>
</table>

Ancillary preferences vary by Context for Travel

<table>
<thead>
<tr>
<th>1st checked bag</th>
<th>Champagne dinner</th>
<th>Pre-reserved seats</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd checked bag</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Advanced decision support for personalized offers

[Image of a webpage showing flight offers and an adaptive decision support system for personalized offers.]
Airline industry builds stronger retailing processes. We are also seeing a significant shift in how airlines choose to distribute their products via direct and indirect channels.
Focus on successes in retailing & distribution

Reach more passengers

Grow revenue per passenger

Increase value per $ spent on distribution
Airlines are enhancing their retailing capabilities to offer new content. NDC enables this new content to flow into the Sabre marketplace.
Technology hype cycle

- Peak of Inflated Expectations
- Trough of Disillusionment
- Plateau of Productivity
- Chasm

Time
Visibility

Innovators
Early Adopters
Early Majority
Late Majority
Laggards
Intelligent offer management – airline and marketplace

For Airlines

Right bundle (air + air ancillaries), right customer, right price, right time

- Segmentation based on travel context
- Bundle based on persona
- Present personalized offer (Segment of ONE)

Trip purpose segmentation
Recommendation engine
Preference-based personalization

For Marketplace

Determine optimal value-based display of non-homogenous supplier content in the Sabre marketplace

- Airlines respond to shopping requests
- Value Scoring of non-homogenous content
- Itinerary selection and order of display

- NDC messaging standard
- Machine learning predictive models
- Display ordering based on value

Personalized Offer

Next Gen Storefront

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Competitive revenue management: real-time changes

Sabre’s commitment to Dynamic Pricing is two-fold:

- Enable distribution of new Dynamic Pricing Content from suppliers to Sabre marketplace
- Deploy a Dynamic Pricing Engine for interested airlines. The model will send dynamically priced itineraries on-demand to airline websites and marketplaces (GDSs)

Prevailing market conditions (i.e., competitive shopping data)

Competitive Revenue Management

DYNAMIC AVAILABILITY
with inventory overrides

DYNAMIC PRICING
continuous pricing or laddered pricing

Challenges
- Volumes / scalability
- Interline
- Regulatory
- Revenue accounting
- Fare management
- Servicing
- RBD-based programs
Dynamic pricing – airline and marketplace view

**For Airlines**

Determine optimal dynamic price for an itinerary based on prevailing competitive market conditions

- **Book and price or shopping request**
- **Dynamic Pricing algorithm for the optimal price**
- **Send results to airline website and GDS on demand**
- **Display the itineraries and dynamic prices**

**For Marketplace**

Instant access to new dynamically priced content from airline suppliers to the Sabre marketplace

- **Travel agent: book and price or shop requests**
- **Airline sends new dynamically priced itineraries to GDS**
- **SR 360 displays dynamically priced itineraries**
- **Travel agency shop and book**
- **Dynamic prices via new messaging standard**
- **Display dynamic prices on agency desktop**

- Sabre will have access to all dynamically priced content generated by airlines for travel agents to sell
- Sabre receives dynamically priced content via the new ATPCO messaging standard
Dynamic Packaging – Marketplace View

Context for Travel + Purchase History based Preferences

Start

Travel Agency

Advance Purchase Length of Stay
Number in Party Day of Week
Saturday Night Stay Length of Haul
Channel One-way vs R/T

Purchase History

Traveler preferences mined by Recommender System

Display hotels based on traveler preferences

Infuse recommendations with seldom-booked properties

Finalize booking to evaluate recommendations

Test & Learn Experimentation

Personalized hotel recommendations based on purchase history and preference

Continuous improvements through MAB Test & Learn Experimentation
PRIVATE SECTOR BEST PRACTICES
Leverage learning from private sector to apply private sector best practices and utilize lessons learned in a government environment.
Benchmarking a corporation’s travel activity with similar-size corporations.

Providing insights to Travel Managers on policy compliance, cost and traveler behavior by destination.
In today’s climate it’s less about cost control and more about risk control.
Artificial Intelligence in Travel
Artificial Intelligence at Sabre

AI isn’t just about chatbots. AI will enhance every product in our portfolio and power features that learn over time across process automation, cognitive insight and cognitive engagement.

We’ve created a company-wide AI Special Interest Group (AISIG), and are training not only developers, but product managers, designers, and leaders to identify new ways to use AI.

Sabre is already using AI for:

- Customer Segmentation
- Shopping Displays & Efficiency
- Pricing recommendations
- Dynamic bundle creation
- Flight delay prediction
- Passenger name matching
- Flight plan optimization
- Test & learn experiments
- System monitoring
- And much more...
AI/ML Initiative

AI NEWS
Quarterly Newsletter
Vol 2, No. 2
April - June 2019

SAFETY INTELLIGENCE QUARTERLY REPORT
April – June 2019

SAFEBREX
Quarterly Newsletter
Vol 2, No. 2
April - June 2019

AI Toolkit Evaluation

Categories of Algorithms

- **Supervised Learning**
  - Develop predictive models based on both input and output data
- **Semi-supervised Learning**
  - Reward-based
- **Unsupervised Learning**
  - Clustering
- **Reinforcement Learning**
  - Discover an internal representation from input data only

**Type of Learning**

**Categories of Algorithms**

- Classification
- Support Vector Machines
- Discriminant Analysis
- Naive Bayes
- Nearest Neighbor
- Regression
- Linear Regression
- Decision Trees
- Ensemble Methods
- Neural Networks
- GMM
- Multiple Linear Regression
- Principal Component Analysis
- Nearest Neighbors
- K-Means, Hierarchical, Fuzzy C-Means
- Hidden Markov Model
- Principal Component Analysis
- Neural Networks

**DATA ANALYST PLATFORMS**

- Google BigQuery
- Azure Machine Learning
- IBM Watson
- Amazon SageMaker
- Splunk

**DATA SCIENCE PLATFORMS**

- Jupyter Notebook
- RapidMiner
- KNIME
- Alteryx
- KNIME

**MACHINE LEARNING**

- TensorFlow
- Scikit-Learn
- PyTorch
- Keras
- Turi Create

**AI / MACHINE LEARNING / DEEP LEARNING**

- AWS SageMaker
- Google Cloud ML Engine
- IBM Watson
- Microsoft Azure Machine Learning

**COLLABORATION**

- Open Source
- Cloud Providers

**Commercially Licensed**

- IBM
- Microsoft
- Google
- Amazon

**AI/ML Initiative**

Sabre is building an AI platform to help its customers become more intelligent and efficient. The company is investing in AI technology to transform the travel industry. The platform will allow travel agents to more quickly find the best deals for their clients, improving customer satisfaction.

**Categories**

- **Algorithms**
- **Evaluation**

**AI/ML Initiative**

Sabre held a session at the Arabian Travel Market Conference in Dubai, where an AI/ML initiative was announced.

Travel Management Company (TMC) and Sabre, a leading travel technology provider, are partnering to develop an AI-driven platform that will analyze vast amounts of travel data to provide insights that help travel agents make better decisions.

**AI/ML Initiative**

Sabre is making significant investments in AI and machine learning technology to improve its ability to predict travel trends and provide personalized recommendations to its customers.
AI/ML Examples

Name Separation Model

- Algorithmically decipher the MRZ for both PNR look-up and SSR to create data input
- Supervised Learning – traditional ML methods (Decision Trees, SVM, Boosting, Bagging, Random Forest) and Deep Learning to identify ethnicity
- With known (predicted) ethnicity, apply a rules engine to determine Last Name and First Name
- An expert (AI Local Account Admin) validates the results
- Baseline accuracy improved from 20% to ~60% - ~75% with traditional ML methods. SVM performed the best with an accuracy of ~75%
- Deep learning model (Recurrent Neural Nets (RNN) with Long short-term Memory (LSTM) marginally outperformed traditional ML methods by ~10%
- Translates code to incorporate into Kiosk product

Detecting Robotic Shops

Unsupervised Learning to Determine Context for Travel (Trip Purpose Segments)

- Continuous Learning: User Preference Updates to the Universal Profile

Air Shopping with Segmentation & Personalization
AI/ML Examples (cont’d)

Preference-Driven Air Shopping

Branded Fares using Genetic Algorithms

~10,000 branded fares, containing attributes & price

SELECT PROFITABLE PLANS AS PARENTS

REPLACE LESS PROFITABLE DESIGNS

RANDOMLY SELECT A CROSSOVER POINT

GET NEW INDIVIDUALS (BRANDED FARES)

Virtual Travel Agent Chatbot Pilot

FEWER CALLS, ENHANCED CONVENIENCE

ENHANCED PRODUCTIVITY

Corporate Travelers

Sabre

DEV STUDIO

Cognitive Services

Microsoft

Facebook

Airline

Hotelier

Corporation

Travel Management Companies
AI/ML Examples (cont’d)

A/B Testing

Customer Segmentation

CONTENT 1
CONTENT 2
CONTENT 3
CONTENT 4

MANUAL SELECTION

Allocation of experiments

MAB

Time

Low Reward
Very Low Reward
High Reward
Medium Reward

Time