NORDISK KONFERENS OM ANALYS AV TURISM

The Knowledge Destination –

Customer-based Knowledge through Business Intelligence

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TILLVÄXTVERKET

tourism in skåne
part of business region skåne

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Agenda

NORDISK KONFERENS OM ANALYS AV TURISM

- Knowledge Destination
  - Knowledge Destination Framework
  - Knowledge Destination Architecture
- BI-based Destination Management Information System
  - Destination Data Warehouse Model
  - Examples for Knowledge Generation
  - DMIS-Prototype
- Conclusion & Outlook

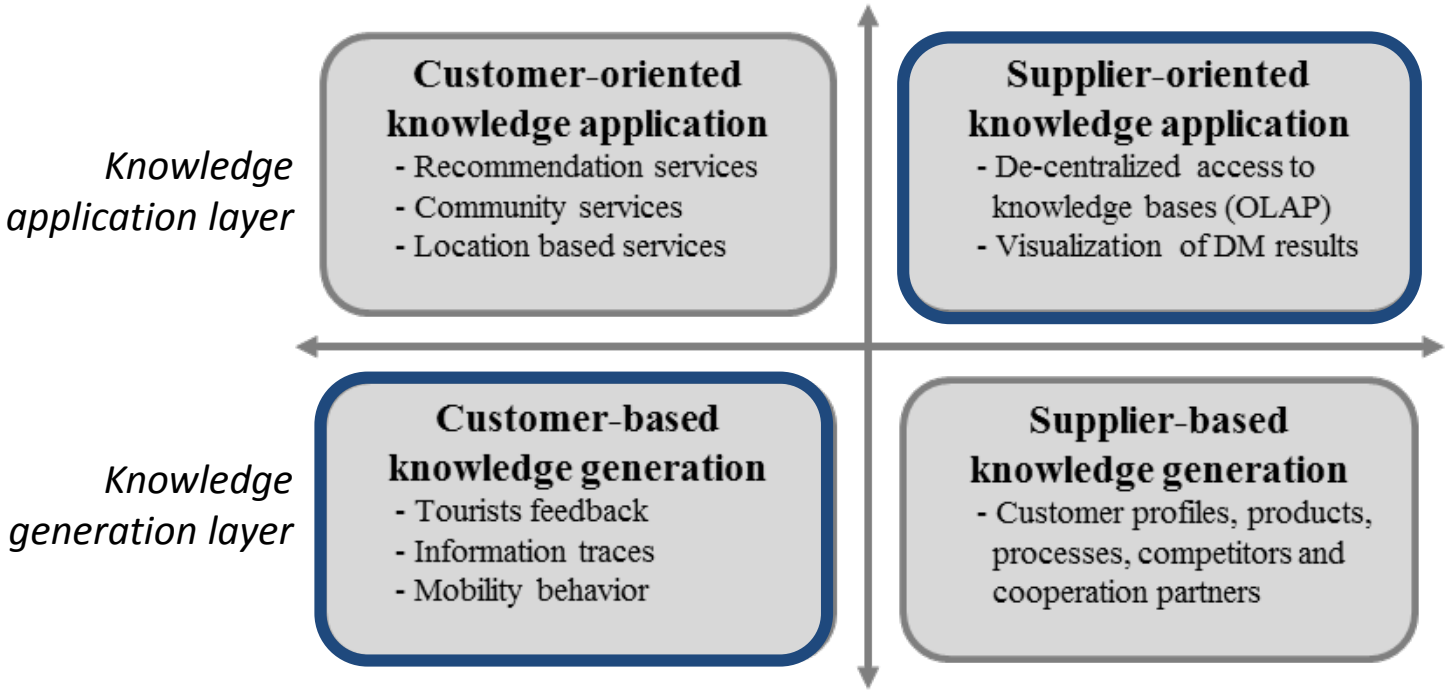
Knowledge Destination

- **Tourism destination: Strategic unit in Travel & Tourism**
  - **Competitiveness of destination** ⇔ attractiveness, **potential to adapt to customer needs**
    - **Knowledge need** for innovation,… resource re-configuration, self-transformation…
- **Learning Tourism Destination**
  - **External knowledge to develop strategic options ⇔ inclusion of customer**
  - Networked **ICT infrastructure** and **services collecting data for creating, applying and disseminating new knowledge**

Knowledge Destination

- Majority of tourism information, transactions and communication processes **electronically**
  - Customer traces during all trip phases → **large quantity and variety** of ***customer-based data*** in destinations…
    - Transaction data, CRM data, survey data… [**Data bases**]
    - Navigation & search data, UGC,… [**Web Servers**]
  - … large data amount remains ***unused***
- ***Solution***: ***Business Intelligence-based knowledge infrastructure for destinations***
- ***Business Intelligence*** ⇔ **One of 10 technologies changing the world** (MIT Review 2008)
  - BI = {Data Warehousing + Data Mining} ⇔ *Data*: relaxed assumptions of AI → huge in amount
  - Explosive **growth of data flows/collection, storage capacity/computing power, decreasing storage/computing costs** → OS SW for AI Apps (e.g. *RapidMiner™*)

Knowledge Destination Framework



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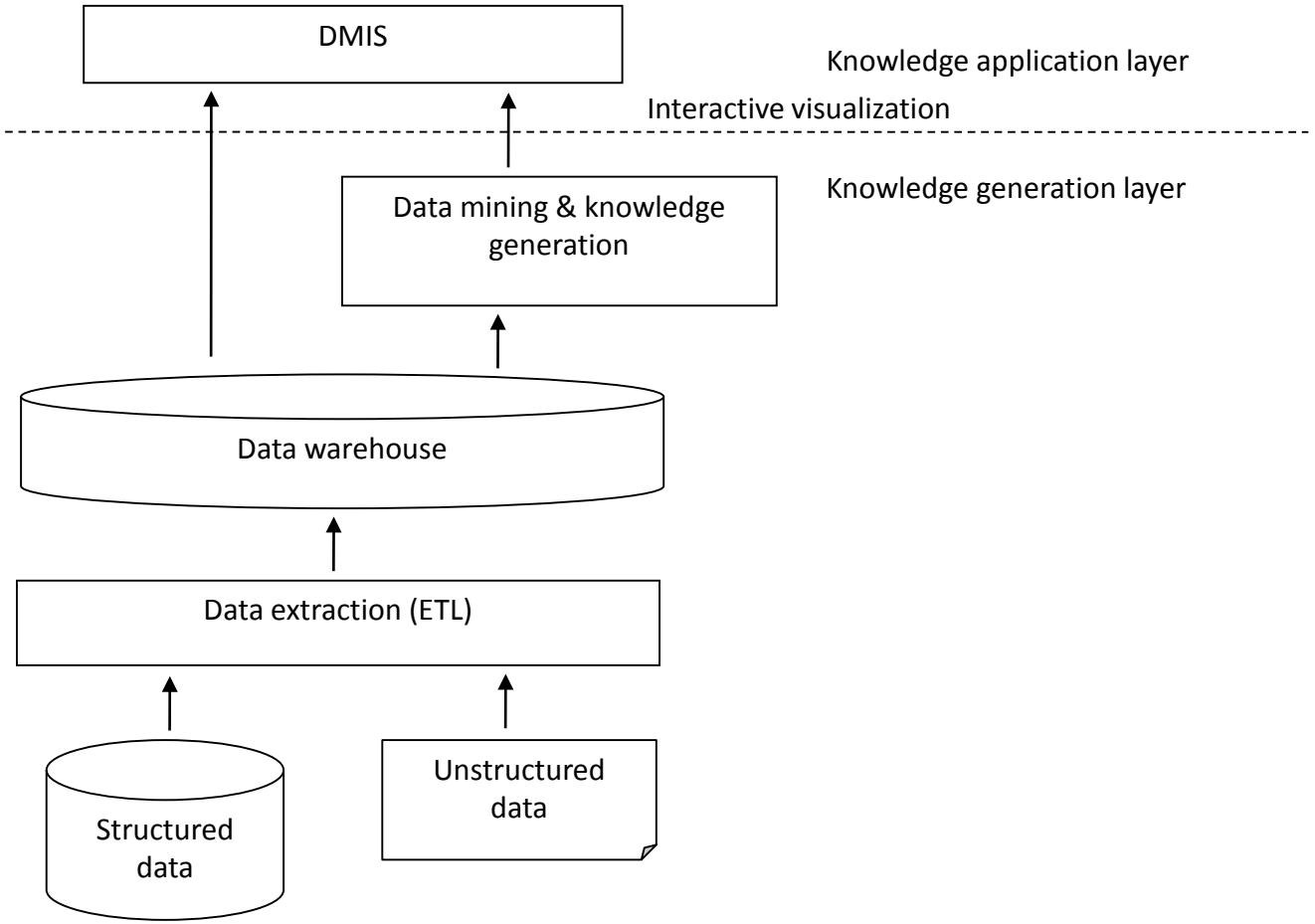
Knowledge Destination Architecture



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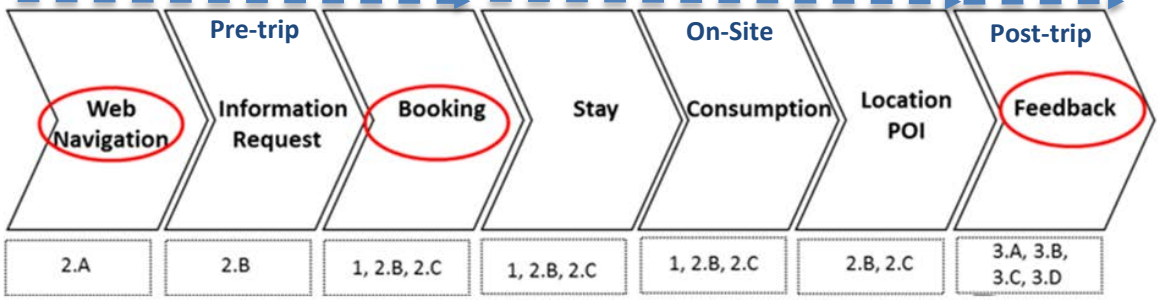
BI-based DMIS

Customer-based knowledge sources [DMIS Inidcators] → DMIS Data Warehouse

- **1. *Economic Performance***
  - Bookings
  - Overnights
  - Prices
  - Sales
- **2. *Customer Behaviour***
  - A. Web Navigation & Search
  - B Booking & consumption Behaviour
  - C Customer Profiling
- **3. *Customer Perception & Experience***
  - A Brand Awareness
  - B Perception of Destination Value Chain Areas
  - C. Value for Money & Customer Satisfaction
  - D Loyalty



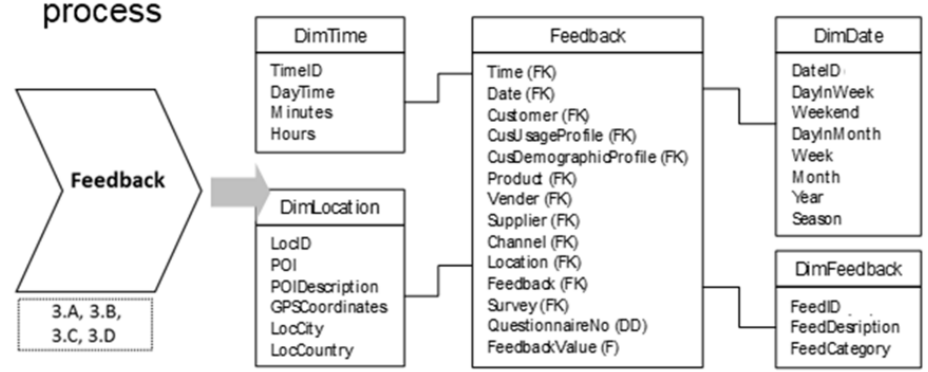
Business events generating **data**

Transaction & process- oriented structure

Multi-dimensional structure supports OLAP

Fact tables interlinked through **shared dimensions ⇔ Cross Process Analyses**

DW composed of **fact & dimension tables** for each business process



Business Process: ***Feedback***

Fact-Dimension Table: ***Feedback***

Business Process	Fact Table	Dimension	Time	Date	Customer	Customer Use Profile	Customer Demo Profile	Product	Vendor	Supplier	Channel	Location	Feedback	Var Feedback	URI	Event	Session	Referral	Survey	Marketing	Connectivity
Info Request	info request		x	x	x	x	x	x		x	x										
Web Navigation	click fact table		x	x	x	x	x	x		x					x	x	x	x			
	session fact table		x	x	x	x	x								x		x	x			x
Booking	booking		x	x	x	x	x	x	x	x	x										
Stay	stay			x	x	x	x					x									
Consumption	consumption		x	x	x	x	x	x	x	x		x									
Location Tracking	location poi		x	x	x	x	x					x									
Feedback	feedback		x	x	x	x	x	x	x	x	x	x	x	x					x		
Capacity (rooms)	capacity			x				x	x	x											
Marketing Activity	marketing activity			x				x	x	x	x									x	

Höpken, W., Fuchs, M., Höll, G. Keil, D. & Lexhagen, M. (2013). Multi-dimensional data modelling for a tourism destination data warehouse, In Cantoni, L. & Xiang, Ph. (eds.) *Information and Communication Technologies in Tourism*, Springer, New York: 157-169.

BI-based DMIS

Examples for knowledge generation through BI

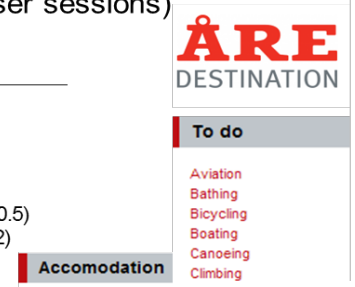
Web Usage Mining

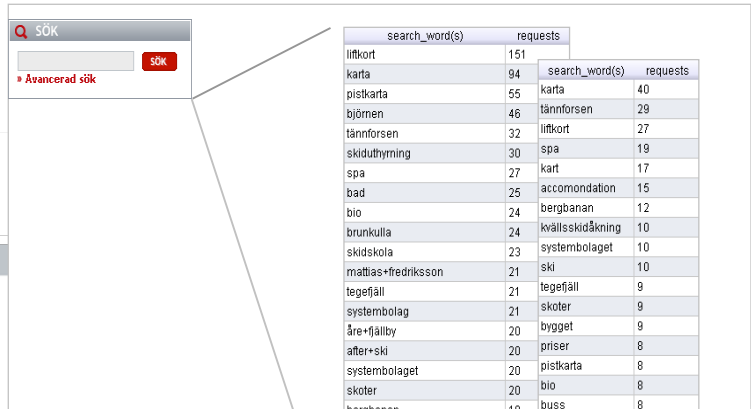
www.visisitare.se

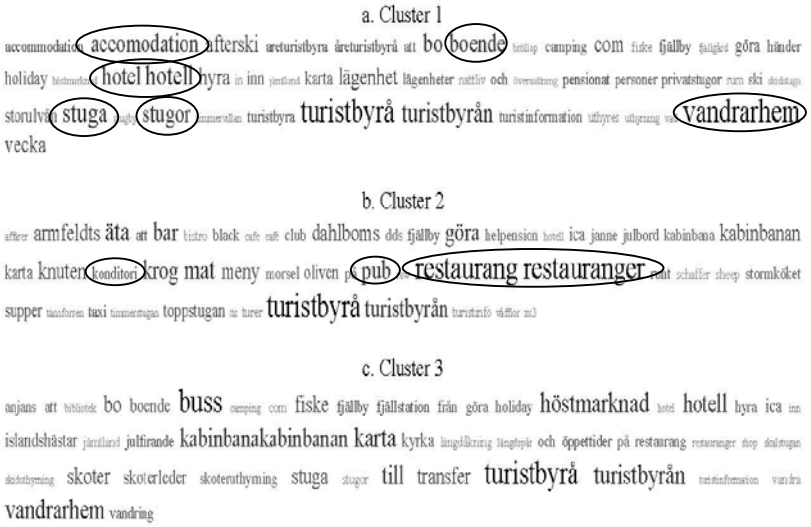
Clustering ⇔ Log files Aug 2008 - Mar 2009 (92,035 user sessions)

- X-Mean Clustering ($2 \le x \le 30$) by categoy change

	Cluster 1	Cluster 2	Cluster 3
Size	8.7% (7,989)	3.1% (2,839)	88.2% (81,143)
Duration	12.6 min	12.2 min	2.5 min
Selection	Accomm. (80%; a/s 6.4) Program (29%; a/s 1.9) To do (26%; a/s 1.9)	Eating (100%; a/s 8.4) To do (33%; a/s 1.6) To see (21%; a/s 0.8)	To do (28%; a/s 0.7) Accomm. (27%; a/s 0.5) To see (9.2%; a/s 0.2)
Actions	Tourism (11.2%)	Brochure (7.6%) Congress (7.2%)	PDF (6.8%)
Ext. Search	Services (17.5%) Accomm. (10.5%) Activities (3.1%)	Eating (13.5%) Services (12.5%) Activities (2.1%)	Services (14%) Activities (6.6%) Accomm. (6%) Skiing (3.1%)
Int. Search Used after	3.4 min	3.8 min	1.3 min
	Accomm. (22%) Skiing (5.5%) Activities (5.1%)	Accomm. (17.7%) Eating (12%) Skiing (8.1%)	Accomm. (16%) Services (10.2%) Skiing (8%)
Parametric Used after By	5.1 min 21% (a/s 4.4)	4.3 min 19% (a/s 4.9)	1.5. min 6% (a/s 1.9)





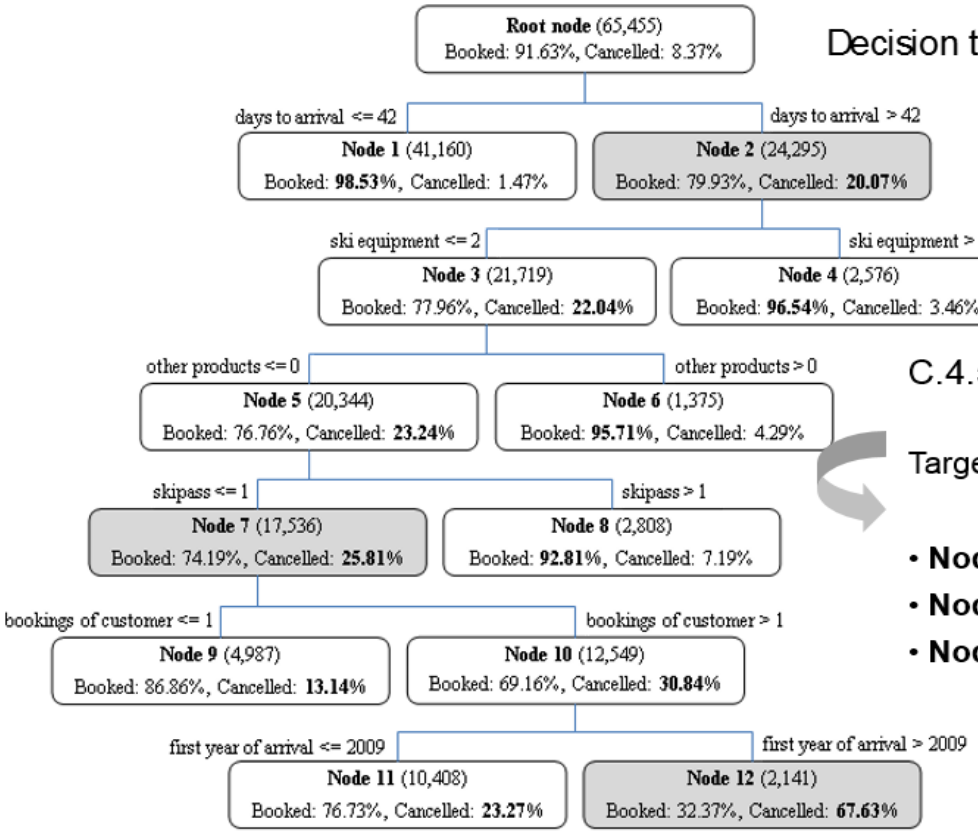


Pitman, A., Zanker, M., Fuchs, M. & Lexhagen, M. (2010). Web Usage Mining in Tourism Destinations – A Query Term Analysis and Clustering Approach. Gretzel, U, Law, R. & Fuchs, M. (eds.), *Information and Communication Technologies in Tourism 2010*, Springer, New York, 393-403.

BI-based DMIS

Examples for knowledge generation through BI

Explaining cancellation behaviour



C.4.5 Algorithm (accuracy 94%, R^2 .23)

Target marketing to prevent cancellation

- **Node 2**: Days to arrival > 42 days (2.4 ↑)
- **Node 7**: Booking ski pass < 1 day (3.1↑)
- **Node 12:** First year of arrival > 2009 (8 ↑)

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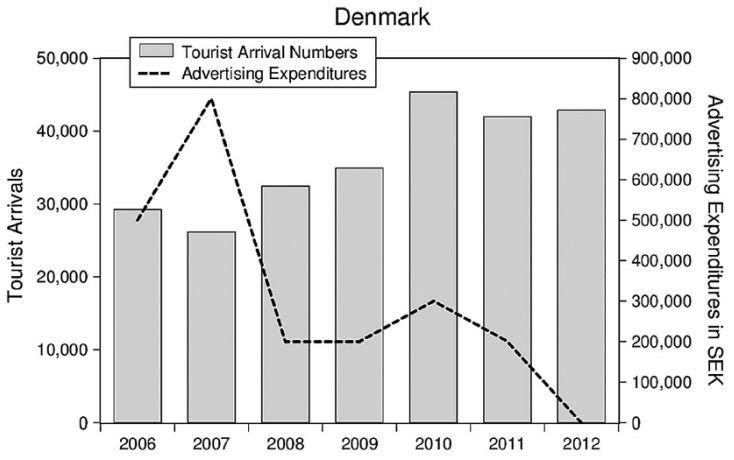
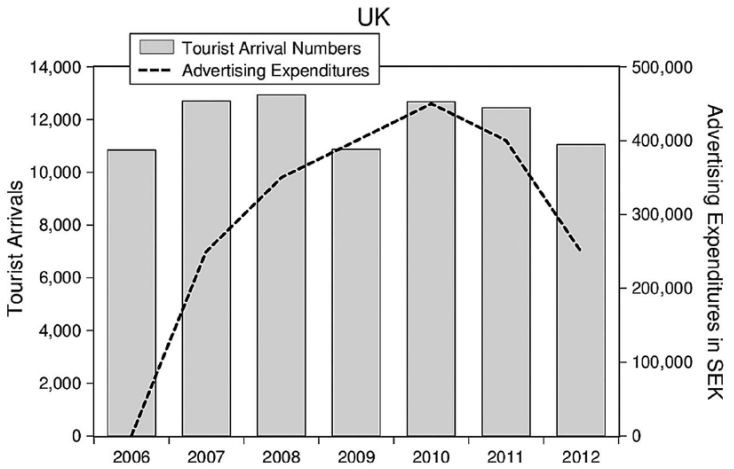
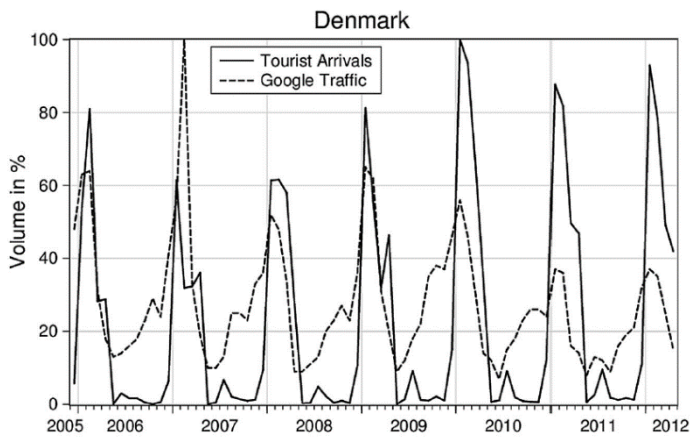
BI-based DMIS

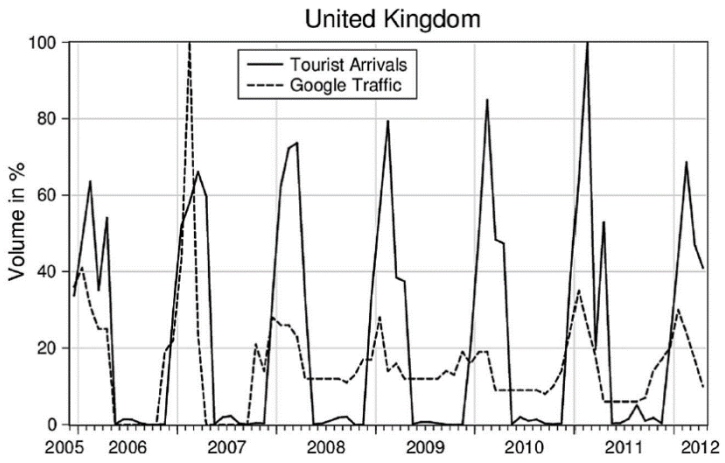
Examples for knowledge generation through BI

Explaining tourist arrivals









Kronenberg, K., Fuchs, M., Salman, K., Lexhagen, M. & Höpken, W. (2015). Economic Effects of Advertising Expenditures – A Swedish Destination Study of International Tourists. *Scandinavian Journal of Hospitality & Tourism Research* (in print).

BI-based DMIS

Examples for knowledge generation through BI

$$Y_{jT} = \beta_0 + \beta_1 \text{GDP}_j + \beta_2 \text{EX}_{Sj} + \beta_3 \text{EX}_{Aj} + \beta_4 \text{Jet Fuel} + \beta_5 \text{Advertising}_j + \beta_6 \text{Advertising}_{(jt-i)} + \beta_7 \text{Online}_j + \beta_8 \text{WorldChampionship} + \beta_9 \text{Winter} + \beta_{10} Y_{jt-i} + e,$$

Table 5. Summary of estimated coefficients of Åre destination's major sending countries.

Variables	Denmark	Russia	Norway	UK	Finland
GDP	14.882	41.051	17.412	5.830	−3.814
EX_S	1.681*	10.482	−.0141	−.001	.090
EX_A	−99.483*	−43.907	.0174	.071	−.379*
Jet Fuel	−2.682	19.844	4.164	−2.292	.541
Advertising	−13.911*	20.623	2.237	8.201*	11.632
$\text{Advertising}_{(jt-i)}$	2.748	53.401*	10.814*	−2.071	−24.129*
$\text{Advertising}_{(jt-k)}$	3.582	82.573*	11.480*	1.232	–
Online	33.612	−114.582*	33.276	10.031	272.858*
WorldChampionship	−4940.242*	−3298.392	−5590.943*	−1029.890	−16754.219*
Winter	6984.531*	3537.121*	4357.733*	907.501*	1283.411
$Y_{(jt-i)}$	−.0401*	−.210*	.031	.443*	.201
Model Statistics					
F-statistics	67.292	8.456	8.794	44.753	19.188
Prob. (F-statistics)	.000	.000	.000	.000	.000
Durbin-Watson	1.712	2.168	1.907	2.382	2.001
R^2	.932	.628	.645	.901	.779

Note: *Significance level < .05;
Lag-periods for the lagged advertising variables $\text{Advert}_{(jt-i)}$ and $\text{Advert}_{(jt-k)}$: Denmark ($i = 3$; $k = 6$), UK ($i = 3$; $k = 6$); Norway ($i = 6$; $k = 10$); Russia ($i = 1$; $k = 9$); Finland ($i = 9$).
Lag-periods for the lagged dependent variable $Y_{(jt-i)}$: Denmark ($i = 11$), UK ($i = 12$); Norway ($i = 10$); Russia ($i = 10$); Finland ($i = 9$).

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DMIS Prototype

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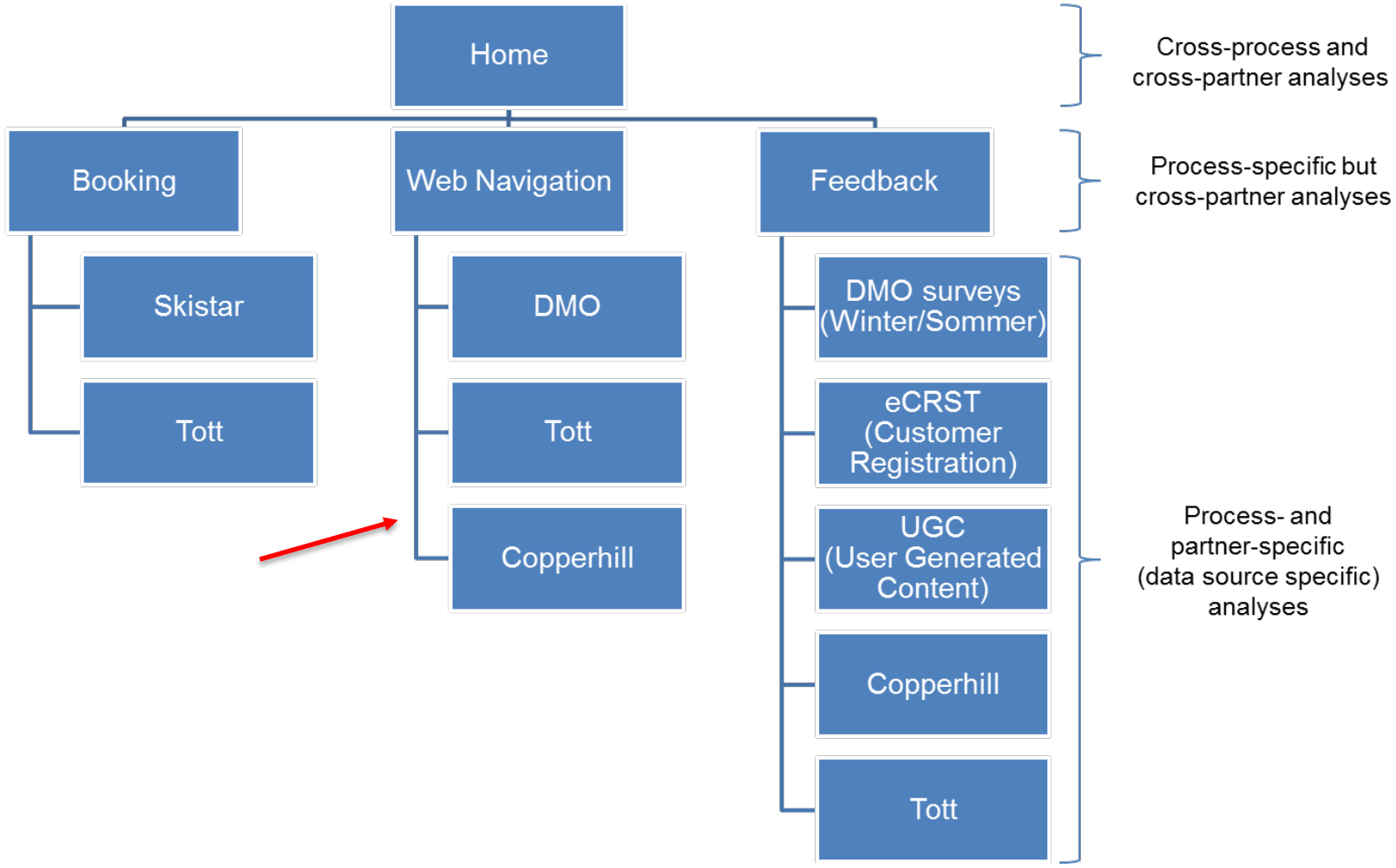

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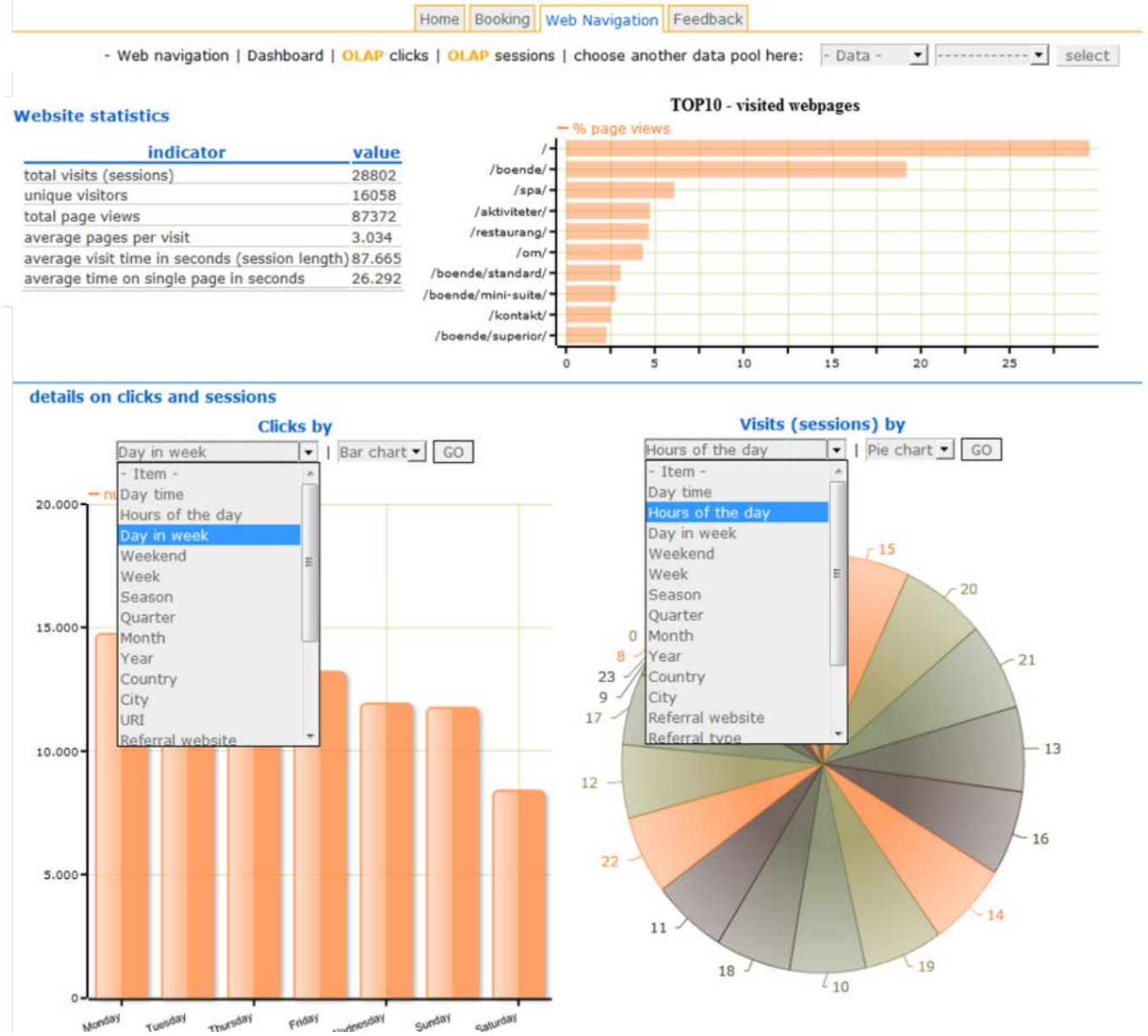

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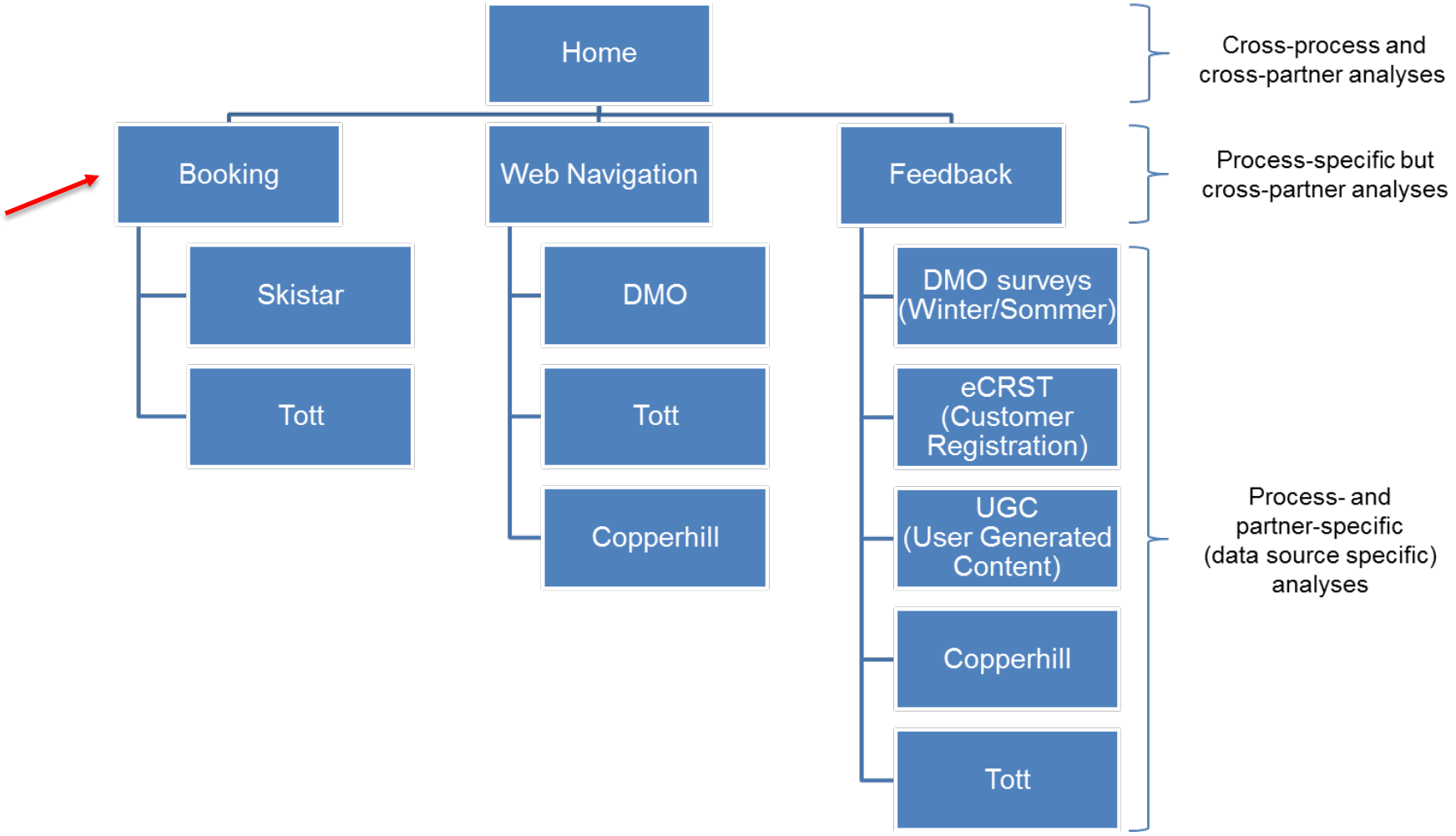

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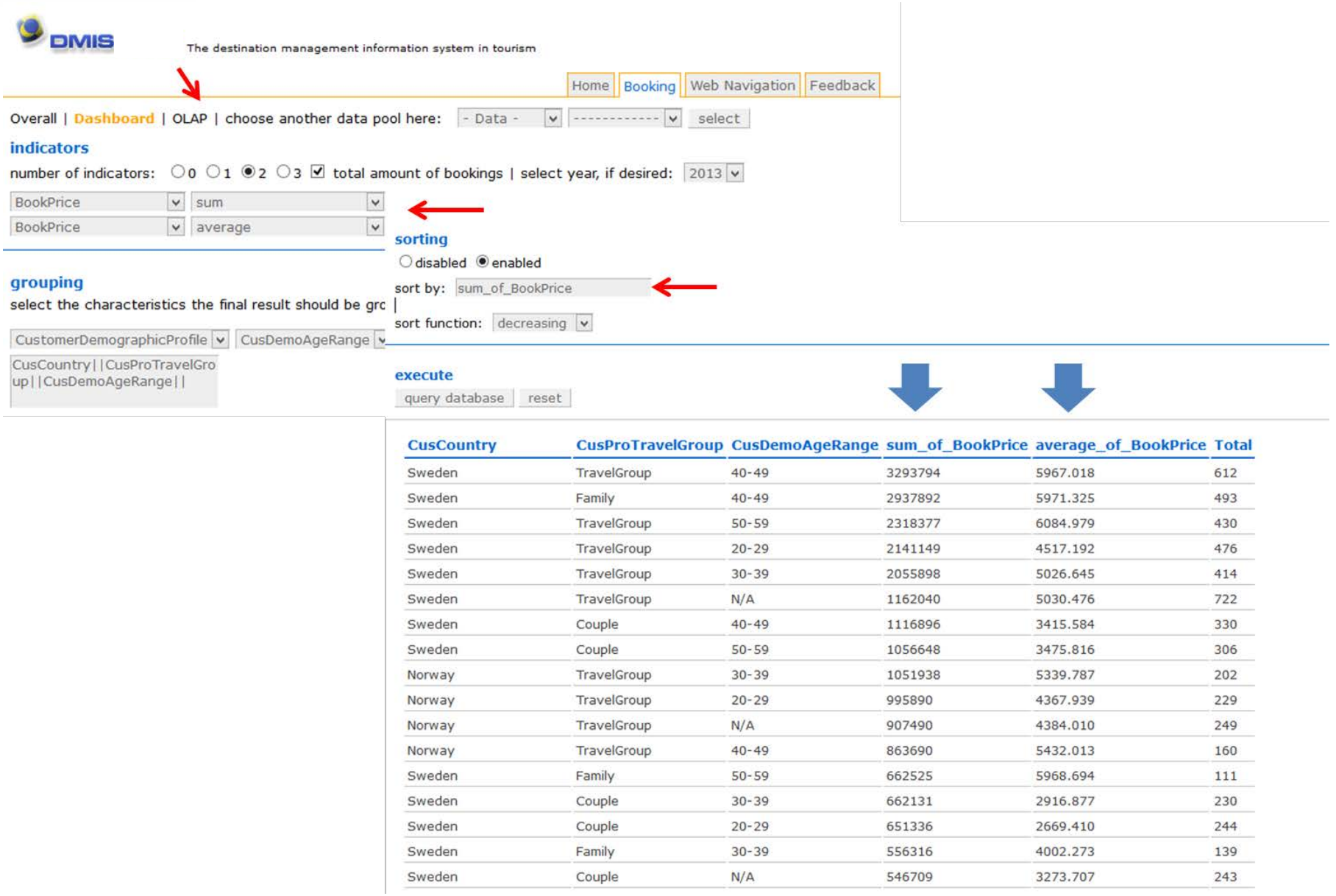
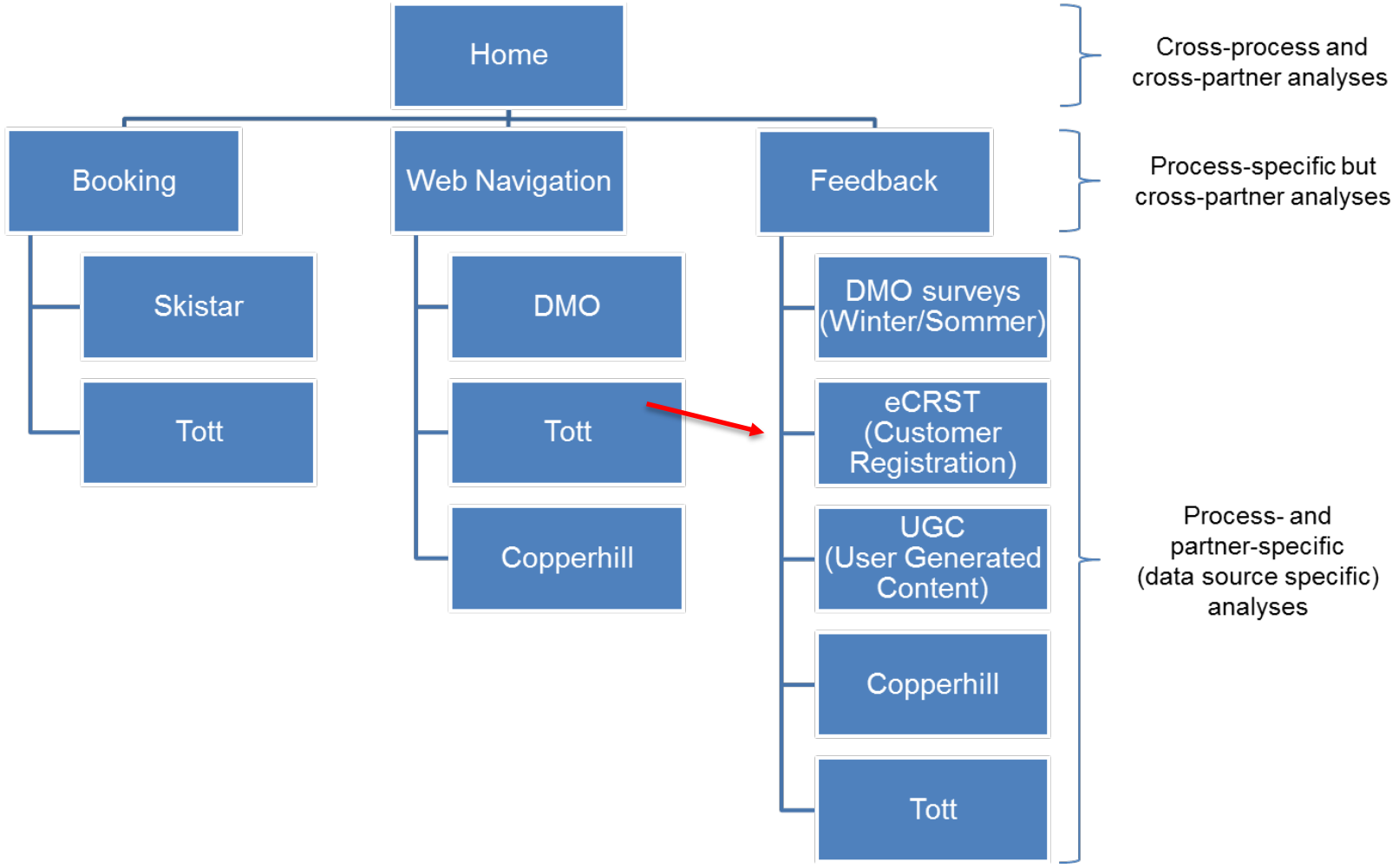


CusCountry	CusProTravelGroup	CusDemoAgeRange	sum_of_BookPrice	average_of_BookPrice	Total
Sweden	TravelGroup	40-49	3293794	5967.018	612
Sweden	Family	40-49	2937892	5971.325	493
Sweden	TravelGroup	50-59	2318377	6084.979	430
Sweden	TravelGroup	20-29	2141149	4517.192	476
Sweden	TravelGroup	30-39	2055898	5026.645	414
Sweden	TravelGroup	N/A	1162040	5030.476	722
Sweden	Couple	40-49	1116896	3415.584	330
Sweden	Couple	50-59	1056648	3475.816	306
Norway	TravelGroup	30-39	1051938	5339.787	202
Norway	TravelGroup	20-29	995890	4367.939	229
Norway	TravelGroup	N/A	907490	4384.010	249
Norway	TravelGroup	40-49	863690	5432.013	160
Sweden	Family	50-59	662525	5968.694	111
Sweden	Couple	30-39	662131	2916.877	230
Sweden	Couple	20-29	651336	2669.410	244
Sweden	Family	30-39	556316	4002.273	139
Sweden	Couple	N/A	546709	3273.707	243

DMIS Prototype



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e-Customer Registration & Survey Tool

- Customer profile
- Information about visit
- Ad-hoc r feedback

How would you describe the motive for your visit to Åre? *
- Main reason for the trip
- An important stop on a longer trip
- Quick stop on a longer trip

Which of the following activities have attracted you to Åre this summer?
- Aviation
- Bicycling
- Climbing
- Events
- Fishing
- Golf
- Guided tours
- Hiking
- Horse riding
- Mountain biking
- Riding the cable car
- Shopping
- Sightseeing
- Spa and pool
- Sunbathing and swimming
- Water sports
- Other

Would you like to tell us about your experience stay in Åre?

Positive experience

(Maximum characters: 160)
You have 160 characters left.

Negative experience

(Maximum characters: 160)
You have 160 characters left.

To what extent are you satisfied with your recent stay in Åre? *

1 2 3 4 5

Not satisfied at all ○ ○ ○ ○ ○ Highly satisfied

Type of accommodation *
- Hotel
- Camping
- Rented cottage
- Own cottage
- Rented apartment
- Own apartment
- Accommodation owned by relatives or friends
- Other

Accommodation area
- Åre village
- Björnen
- Tegefjäll
- Duved
- Other

Name of accommodation / service provider

Survey registration

Particulars of your stay

Date of arrival * / / (month / day / year)

Date of departure * / / (month / day / year)

Number of adults in your travel group

Gender *
- Male
- Female

Number of children i your travel group

Year of birth *

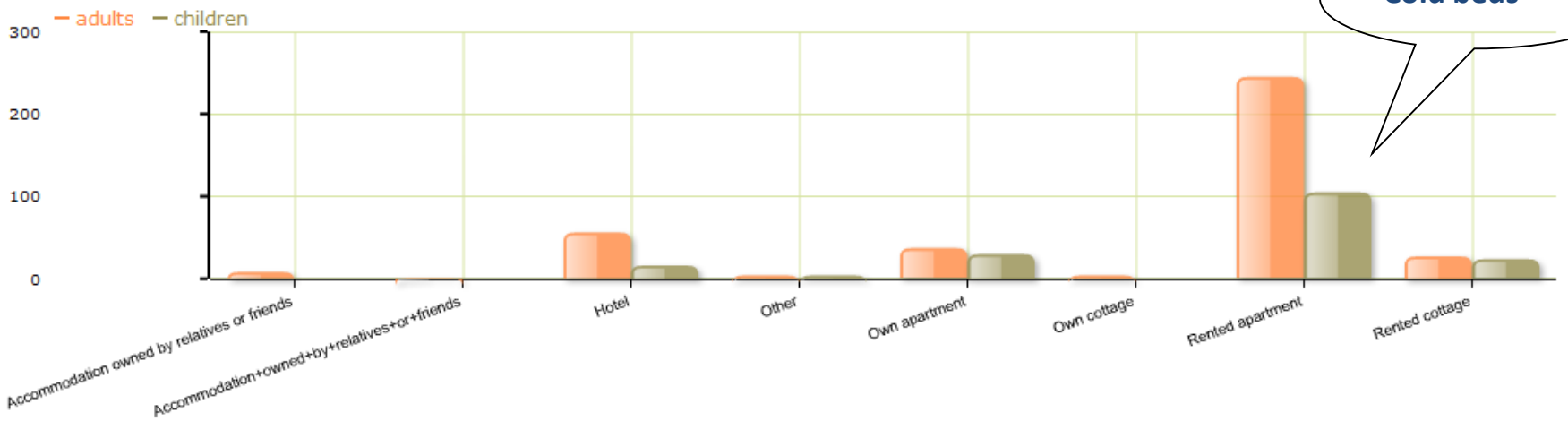
Country of residence *
- Denmark
- Estonia
- Finland
- Germany
- Latvia
- Lithuania
- Netherlands
- Norway
- Poland
- Russia
- Sweden
- UK
- Other country

DMIS Prototype

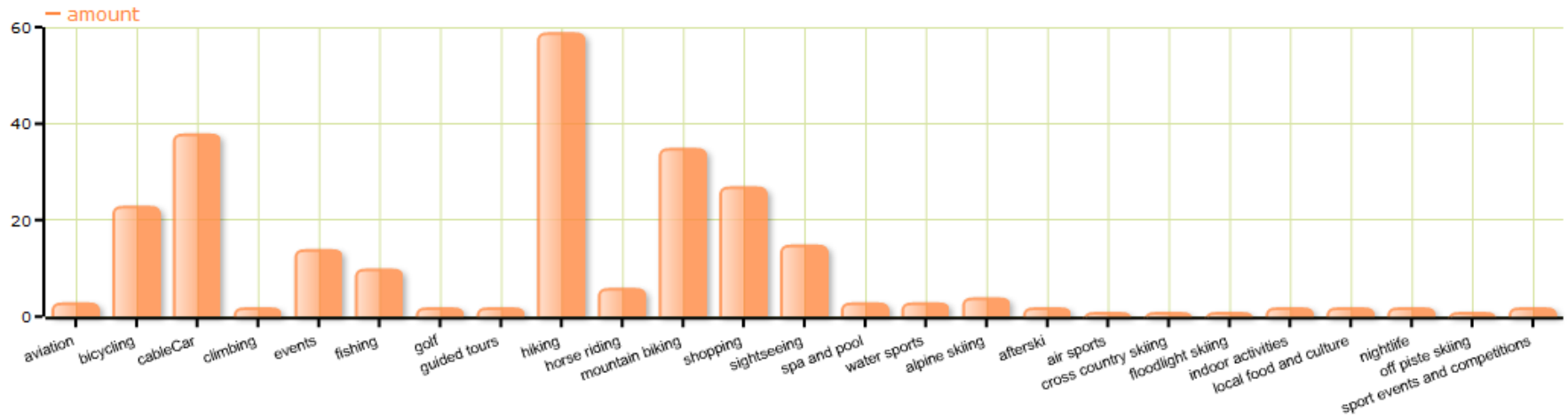
Home | Booking | Web Navigation | Feedback

DMO - eCRST | Dashboard | OLAP | choose another data pool here: - Data - ---------- select

guest summary - total guests | by accommodation type select travel motivation - please select - select



guest summary - total guests | by - please select - select travel motivation activity overview select



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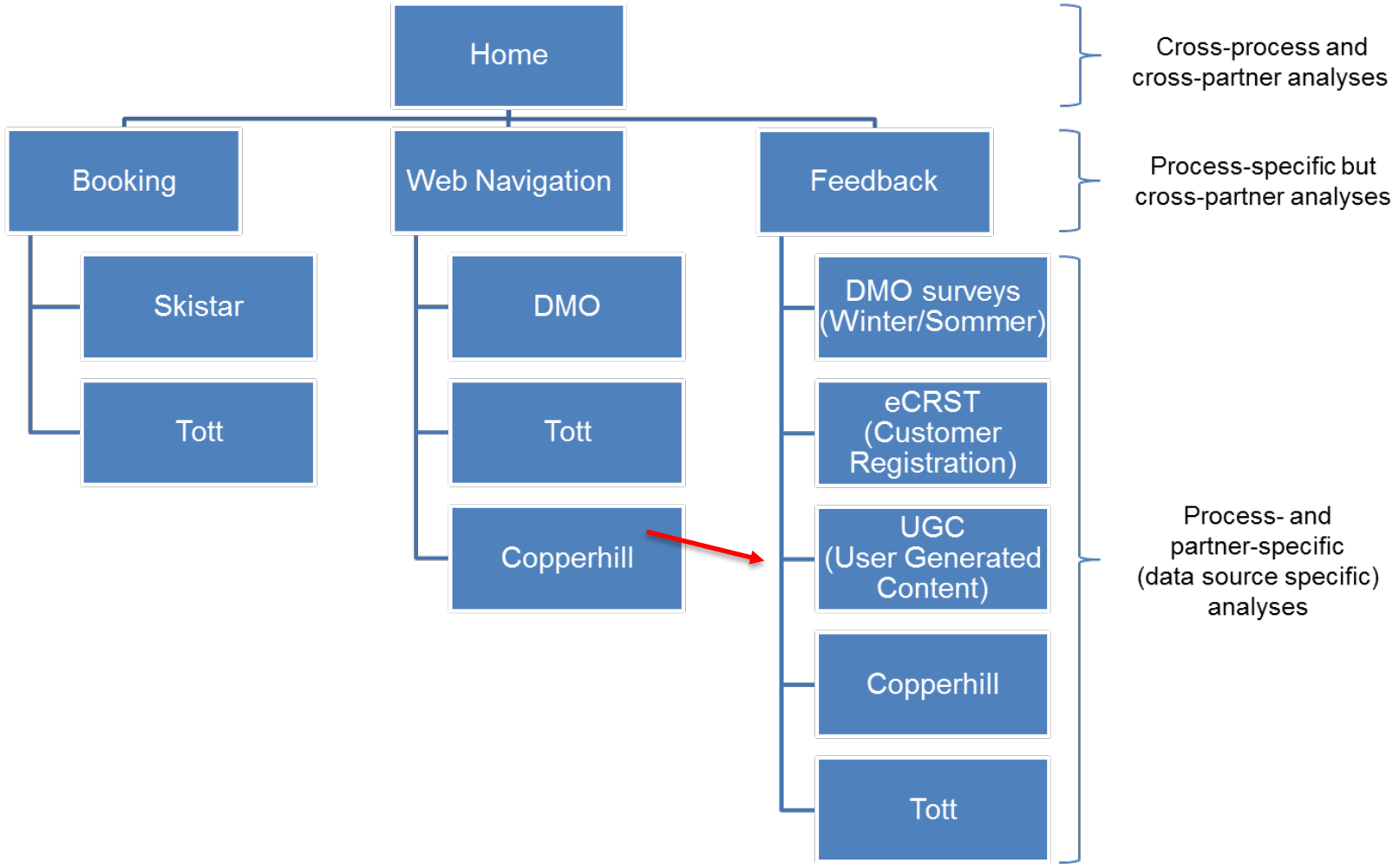

DMIS Prototype

Text data mining → opinion mining (polarity)

1) Document selection ⇔ Åre hotels on leading **review portals**

	No. of Hotels	No. of e-reviews
Tripadvisor.com	10	248
Booking.com	17	1193

2) Document Processing

- **Extract review texts** from HTML documents
- Remove reviews with no text, filter **English texts only**
- Generate **single statements**

	No. of reviews	No. of statements
tripadvisor.com	127	1296
booking.com	81	220
Total	208	1516

Schmunk, S., Höpken, W., Fuchs, M. & Lexhagen, M. (2014). Sentiment Analysis – Implementation and Evaluation of Methods for Sentiment Analysis with Rapid-Miner®, In Xiang, Ph. & Tussyadiah, I. (eds.) *Information and Communication Technologies in Tourism* 2014, Springer, New York 253-265.

DMIS Prototype

3) Mining

Machine Learning (*Naïve Bayes, SVM, k-NN*) ⇔ **Dictionary-Based**

- **Property recognition** ⇔ 100 training data/method, 7 classes
- **Subjectivity recognition** ⇔ 300 training data/method, 6,800 opinion words (Liu 2008)
- **Sentiment recognition** ⇔ 250 training data/method; 2,000 pos., 4,800 neg. words

4) Evaluation

Method	Accuracy
Property recognition	
SVM (with POS tagging)	72.36%
Naïve Bayes (with POS tagging)	49.72%
k-NN (with k = 8)	57.08%
Dictionary-based	71.28%
Subjectivity recognition	
SVM	65.50%
Naïve Bayes	60.67%
k-NN (with k = 5)	55.50%
Dictionary-based	82.63%
Sentiment recognition	
SVM (with bigrams)	76.80%
Naïve Bayes (with trigrams)	69.80%
k-NN (with k = 8)	69.60%
Dictionary-based	71.28%

Part of speech tagging for parsing

⇔ 2 adjacent words → 1 word

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DMIS Prototype

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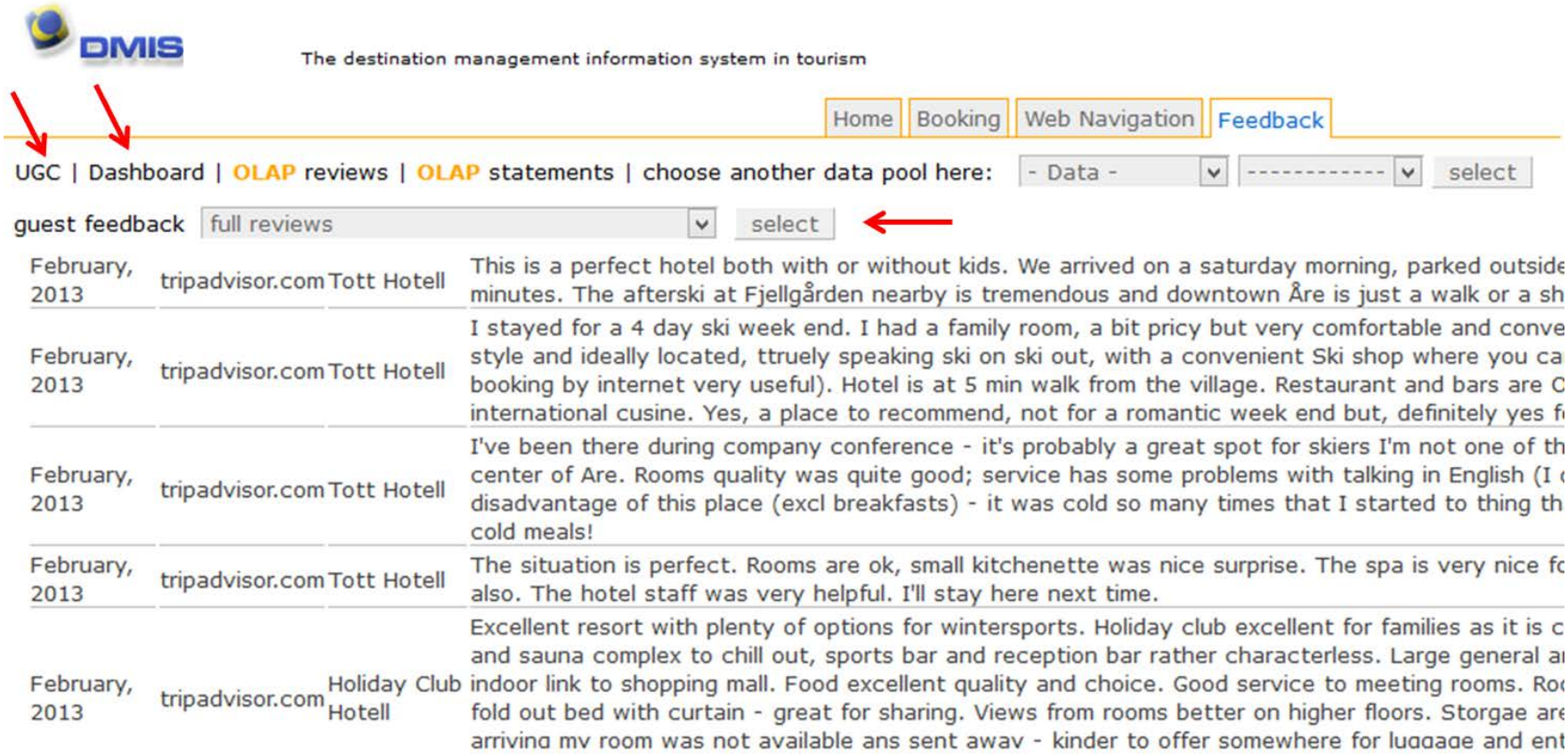

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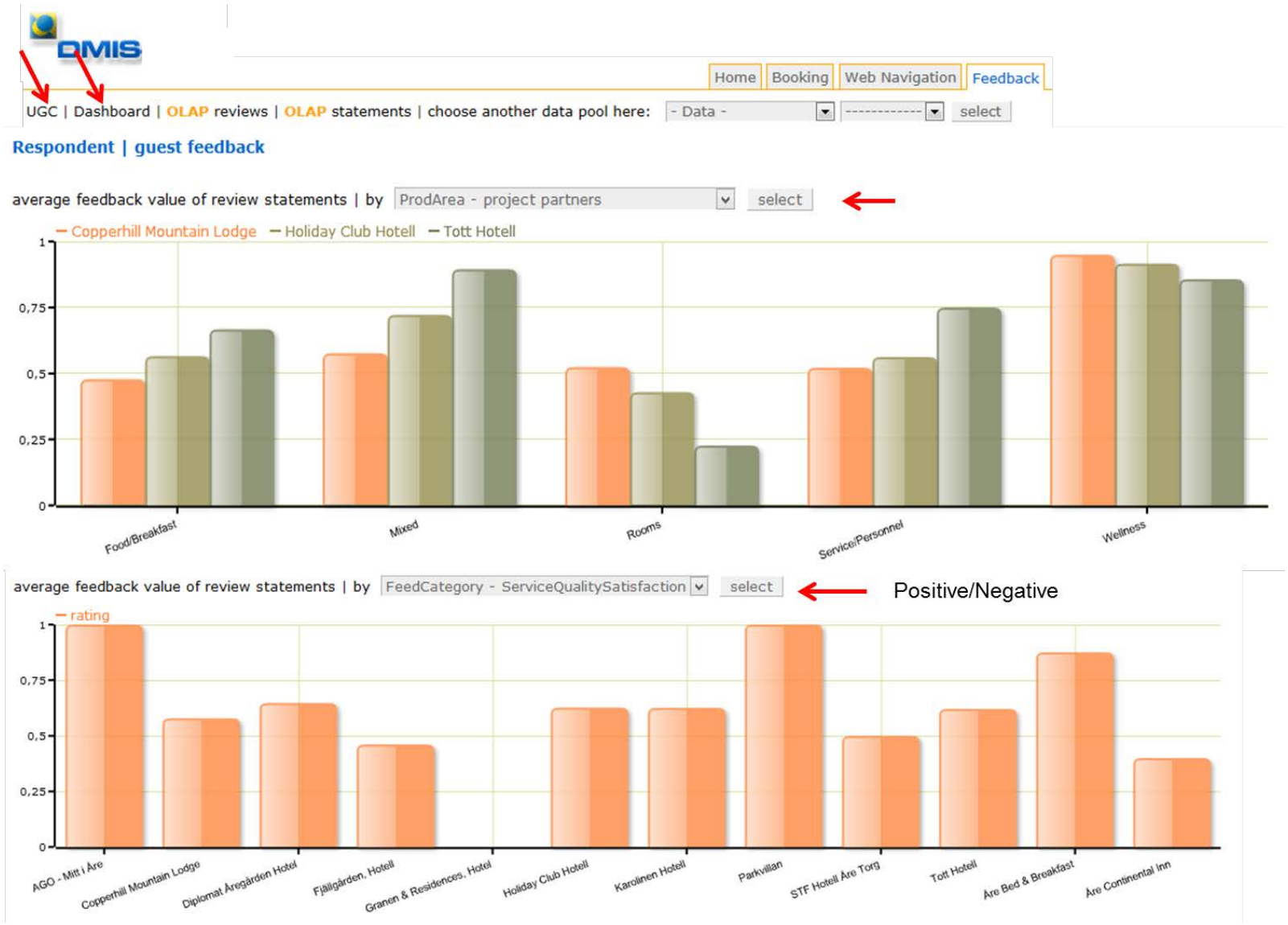

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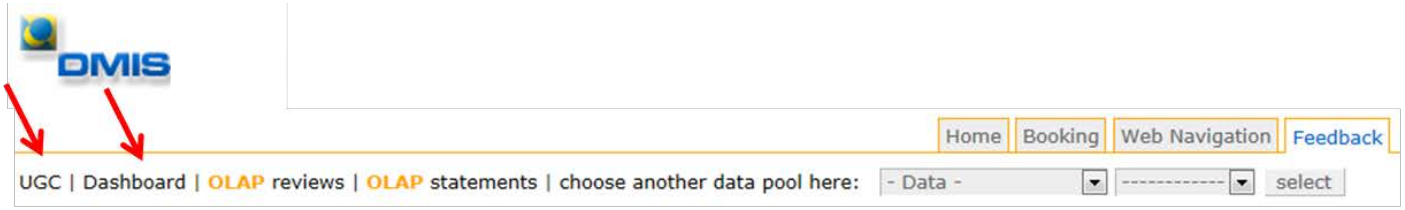
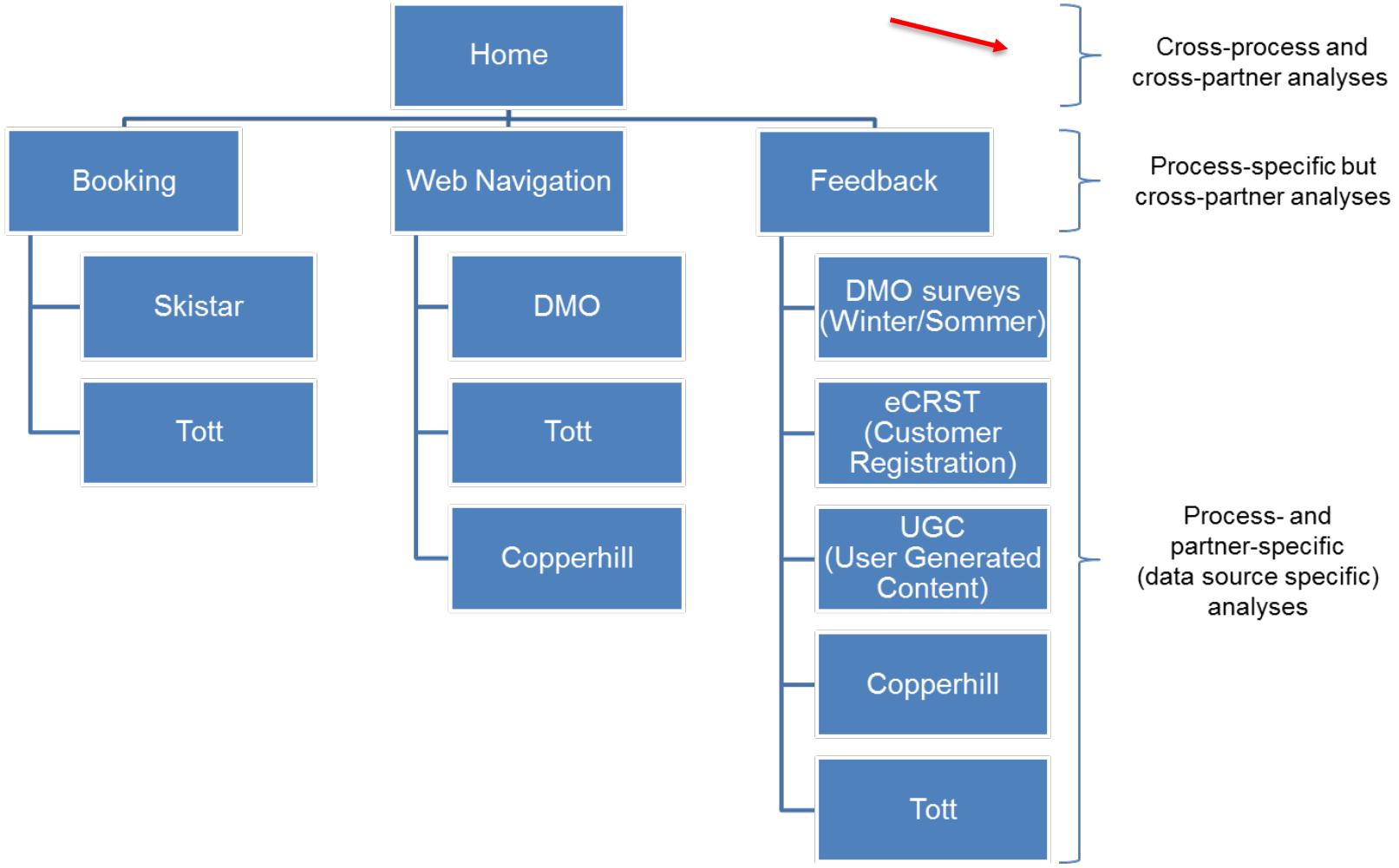


average feedback value of review statements | by ProdArea - all values select

items	Copperhill Mountain Lodge	Diplomat Åregården Hotel	Fjällgården, Hotell	Holiday Club Hotell	Karolinen Hotell	STF Hotell Åre Torg	Tott Hotell	Åre Bed & Breakfast	Åre Continental Inn	Granen & Residences, Hotel	MårtenLiens Gård	AGO - Mitt i Åre	Park
Food/Breakfast	0.478	0.704	1	0.565	0	0.500	0.667	0.667	1	?	?	?	?
Location	0.841	0.938	0.556	0.772	1	0.909	0.933	1	0.667	0	1	?	?
Mixed	0.576	0.633	0.667	0.722	1	0.625	0.895	1	0.625	0	?	1	1
Rooms	0.524	0.500	0	0.429	0.333	0.333	0.227	?	0.111	?	?	?	?
Service/Personnel	0.522	0.750	0	0.562	?	0.500	0.750	1	1	?	?	?	?
Wellness	0.950	0.778	?	0.917	?	?	0.857	?	1	?	?	?	?

DMIS Prototype



DMIS Prototype

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DMIS

The destination management information system in tourism

Home | Booking | Web Navigation | Feedback

Frequently viewed product areas on websites

KPIs | by

Country | GO | 2013 | ☑ null values | ☐ new window

Group by attribute	Total bookings	Total clicks	Total feedback, answers	Total sessions	Average booking price in SEK	Average number of persons per booking	Average time between booking and arrival in days	Average stay duration per booking	Average time spent on single webpage in seconds	Average visit time on websites in seconds	Average pages visited on websites	Average feedback value
Finland	3155	4543	1039	893	7852.046	4.386	95.536	6.160	16.915	100.814	5.087	0.812
France	25	2923	12	739	4616	3.040	38.318	5.042	19.187	82.978	3.955	0.715
Germany	105	3268	150	665	5307.040	3.155	124.426	6.644	13.377	82.701	4.914	0.837
Spain	13	1096	0	305	4776.231	3.231	35.385	3.846	13.889	64.287	3.593	0
Sweden	56073	162942	36880	39139	5023.956	3.860	83.014	5.498	17.407	84.981	4.163	0.773
Switzerland	48	1398	0	292	4282.787	3.149	51.023	4.957	14.687	84.761	4.788	0
Hungary	2	82	0	33	1480	2	61.500	1	15.917	63.667	2.485	0
Iceland	6	220	0	40	4961.500	3.667	89.333	5.833	21.151	151.440	5.500	0
United Kingdom	1042	48513	303	12843	4929.136	3.009	59.399	6.786	17.259	76.811	3.777	0.765
United States of America	30	4284	16	2307	4719.167	4.036	39.148	4.133	11.236	57.168	1.857	0.539

Fuchs, M., Höpken, W. & Lexhagen, M. (2014). Big Data Analytics for Knowledge Generation in Tourism Destinations – A Case from Sweden, *Journal of Destination Marketing and Management*, 3(4):198-209.

Conclusion

- ***Step towards BI-based Knowledge Destination***
  - Knowledge *generation* ⇔ customer processes **Web Navigation, Booking, Feedback**
  - Knowledge *application* ⇔ DMIS Cockpit **Dashboard, OLAP**
    - **Data mining** in future version (Clustering, Classification, Prediction)
- ***Major project outcome***
  - Performance Indicators ⇔ Multi-Dimensional Destination Data Model
  - Architectural DMIS Framework ⇔ Testable Prototype

Outlook

DMIS II Project: Enhanced experience quality & dynamic need fulfilment through ***Real-Time Business Intelligence*** during ***on-site*** phase **(ERUF Halland Region 2016-2017)**

M-CRM Apps

Promising experience opportunities in RT (crowd situation, mood at POIs,…)

Enhanced DMIS

RT service recovery, RT insights in supply shortages, query redistribution in SBN,…

Knowledge application layer

Customer-oriented knowledge application
- Recommendation services
- Community services
- Location based services

Supplier-oriented knowledge application
- De-centralized access to knowledge bases (OLAP)
- Visualization of DM results

Knowledge generation layer

Customer-based knowledge generation
- Tourists feedback
- Information traces
- Mobility behavior

Supplier-based knowledge generation
- product profiles, suppliers (web-sites), availability (booking engines)
- cooperation (market basket)

RT customer data

QR Codes POIS, Ad-hoc feedback,…

Digital Destination Eco System

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Thank you!

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