Methodological Approach to Establishing Business Intelligence in Telemedicine

Assoc. Prof. Ljerka Luić
ljerka.luic@unin.hr

University North, Croatia
Since the academic year 2001/2002 to date she is a guest teacher for the Telemedicine course within the Biomedicine and Healthcare University Postgraduate Doctoral Study Program at the School of Medicine of the University of Zagreb with a lecture on the topics “Methodological approach to establishing business intelligence in telemedicine” and “Strategic planning of development of e-health”. She is also lectured at doctoral studies Information and Communication Science at the Faculty of Humanities and Social Sciences of the University of Zagreb and at doctoral studies Media and Communication at the University North.

She has published 75 scientific papers in the domain of information and communication science, two books, one chapter in a book and two invited lectures and taken part in 50 international scientific conferences. She is mentor for 2 doctoral these and more than 120 undergraduate and graduate theses and co-author on 25 papers with her PhD students. As a scientific researcher, she has actively participated in 8 national scientific projects and 3 international scientific projects.
Good practice where students participated in activities related to research and innovation at graduate and doctoral level through collaborative learning processes acquired knowledge for active participation in the digital transformation of society and strengthened digital competencies and skills for promoting social responsibility in creating an innovation culture.

---

Methodological Approach to Establishing Business Intelligence in Telemedicine
Business Intelligence, BI

Business Intelligence in Telemedicine

Methodological Approach BI in Telemedicine
Intelligence WHAT?
» Intelligence WHAT?
INTELLIGENCE is...

"... the ability of an individual to cope successfully in new situations.

... the ability ... to understand the world and the ingenuity in facing its challenges." (Wechsler, 1975)
Business Intelligence, BI
» BI is...

Large amounts of RAW DATA

DATA WAREHOUSE

FORECASTING

f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}

Predicting FUTURE customer behaviour

Useful i

BUSINESS INTELLIGENCE

DATA MINING

Searching for hidden patterns

Decision-making support

Graphical ANALYSIS

Spot NEW OPPORTUNITIES

Query & REPORTING
BI is...

“The ability to understand the connection between facts in a way that would lead to the achievement of a desired goal.”

Hans Peter Luhn

In simpler terms: business intelligence represents a process of collecting available internal and significant external data and their conversion into useful information which improve decision making process.
The GOAL of which is...

... generate information from data which will increase business success, to notice the unobvious, unknown and hidden, based on processing a large amount of internal and external data.
Data Explosion
The quality of data, both, needed and those that are digitized data, has increased enormously.

Decision makers need access to a growing number of data and data sources.

ICT enables an exceptional increase in digitally stored data (relatively cheap).

On the one hand, there are huge amounts of data, while on the other hand, there is a constant lack of quality data.
The quality of data, both, needed and those that are digitized data, has increased enormously.

Decision makers need access to a growing number of data and data sources.

ICT enables an exceptional increase in digitally stored data (relatively cheap).

On the one hand, there are huge amounts of data, while on the other hand, there is a constant lack of quality data.
The quality of data, both, needed and those that are digitized data, has increased enormously.

Decision makers need access to a growing number of data and data sources.

ICT enables an exceptional increase in digitally stored data (relatively cheap).

On the one hand, there are huge amounts of data, while on the other hand, there is a constant lack of quality data.
The quality of data, both, needed and those that are digitized data, has increased enormously.

Decision makers need access to a growing number of data and data sources.

ICT enables an exceptional increase in digitally stored data (relatively cheap).

On the one hand, there are huge amounts of data, while on the other hand, there is a constant lack of quality data.
The quality of data, both, needed and those that are digitized data, has increased enormously.

Decision makers need access to a growing number of data and data sources.

ICT enables an exceptional increase in digitally stored data (relatively cheap).

On the one hand, there are huge amounts of data, while on the other hand, there is a constant lack of quality data.
DATA EVERYWHERE, but the user...
- cannot find data when needed
- cannot get data when needs it
- cannot use found data
- does not understand the information
“Set of methodologies and tools allowing data to be used (most often from Data Warehouse) and converting them into information necessary for making business decisions.”

Klepac, Mršić
BI is a set of methodologies and tools...

which includes the following main areas:

» Data Warehouse (DW).
» Data Mining (DM).
» Large amounts of data (Big Data).
» Business Analytics (BA).
» Creation of score cards (Key Performance Indicators).
» Comparing performance indicators (Benchmarking).
Business Intelligence: **WHAT?**
models & BI tools **WITH WHAT?**

**HOW?**
data storage, data mining and data analysis
“Data storage is expensive subject-oriented, integrated, time-dependent and unchanging data to support business decision making process.”

William H. Inmon
DATA WAREHOUSE DW

Features:

- Focuses on the business area
- Immutability of content
- Determination of time
- Integration
Database

... is an organized set of data, which are linked in tables in relational databases.

Data warehouse

... is an organized set of data, in which selected data from the database which are considered to be relevant for business and important for analyses are archived and periodically transferred from the database to the warehouse using the ETL process.
Business Intelligence: **WHAT?**
models & BI tools **WITH WHAT?**

**HOW?**
*data storage, data mining and data analysis*
DATA MINING DM

“A systematic, interactive and iterative (repetitive) execution process and the process of displaying useful, implicit and innovative knowledge from data.” In short: discovering knowledge in data.

William H. Inmon
Prerequisites:

» Large amounts of quality data.
» Expertise and competence in interpreting the obtained results.

Limitations:

» Quantity and quality of data.
» Expertise and competence in the analysis of results.
Business Intelligence: **WHAT?**

models & **BI tools** **WITH WHAT?**

**HOW?**

data storage, data mining and data analysis
DATA ANALYSIS

1.0 TRADITIONAL ANALYTICS

2.0 BIG DATA

3.0 DATA ECONOMY

4.0 AUTOMATED & EMBEDDED

Business Intelligence vs Big Data
DATA ANALYSIS

https://www.nationalach.com/telemedicine-merchant-accounts/
DATA ANALYSIS
Business Intelligence, BI

Business Intelligence in Telemedicine
Business Intelligence That Drives Telemedicine Success

The business intelligence that drives telemedicine success helps improve operational and clinical efficiencies. This leads to improved health outcomes for partner hospitals and health systems. SOC's analytics team provides clinical, operational, and financial data analyses and communications that help SOC clients optimize their resources and make more informed business decisions.
Business intelligence concepts make it possible to use only selected information that is in a certain time necessary for making decisions.

- an important assumption -

Users express their preferences regarding the characteristics and types of information they want to receive as well as their frequency and forms of communication through which the information will reach them.
TELEMED 2022
Ljerka Luić, Keynote Speech

- E-Health
- Diagnose
- Virtual
- Chat
- Doctor
- Medical
- Application
- Healthcare
- Telemedicine
- Remote
- Tablet
- Patient
- Software
- Health
- Computer
- Internet
- Online
- Care
- Video
- Digital
- Web
- AIDT
- Telecomedicina
» Tools for Analytics & BI
Top Tools for Analytics & BI

- Leaders
  - Microsoft
  - Salesforce (Tableau)
  - Qlik
- Challengers
  - Google
  - Domo
- Visionaries
  - MicroStrategy
  - Amazon Web Services
  - TIBCO Software
- Niche Players
  - Pyramid Analytics
  - Alibaba Cloud
  - ThoughtSpot
  - Oracle
  - Sisense
  - IBM
  - SAS
  - Yellowfin
  - Tellius

As of January 2022 © Gartner, Inc
BI TOOLS APPLICATION
**BI TOOLS APPLICATION**

Integrated in-memory technology in telemedicine enables:

- Analysis of large amounts of data
- Real-time access
- Immediate responses to inquiries
- Flexible reports
EXAMPLES OF APPLICATION
EXAMPLES OF APPLICATION

- Budget Summary
  - Gross Charges: Actual: 25,409,90; Budget: 26,680,40; Var: -5%
  - Salaries & Wages: Actual: 8,004,12; Budget: 8,244,244; Var: 3%
  - Other Expenses: Actual: 5,336,08; Budget: 5,122,637; Var: -4%
  - Total Expenses: Actual: 13,340,20; Budget: 13,366,88; Var: 0%

- Charges (% of Plan)
  - Ortho Neuro: 95%
  - Pharmacy: 109%

- Paid FTE's
  - Labor: 135
  - Other: 164

- Avg Hourly Rate
  - Ortho Neuro: $33.43
  - Pharmacy: $40.96

- Overtime as % of Prod
  - Ortho Neuro: 1%
  - Pharmacy: 8%

- Variance % to Budget by Expense Category
- 12 Month Trend - Budget to Actual
METHODOLOGICAL APPROACH to Establishing Business Intelligence in Telemedicine

• Defining the problem
  => WHAT is the problem, WHICH information are available about the problem
  => The research of the problem should be properly and carefully prepared and implemented

• Determination of research objectives and subjects
  => WHAT is the goal - it should be realistic, pragmatic and achievable
  => WHAT is the subject of research - it should be real and tangible

• Selection and application of adequate research methods
  => WHICH methods are reliable, applicable and profitable
  => HOW MANY complementary or different methods should be chosen

• Collection of data and information
  => WHICH data are relevant to the research problem
  => Is the information verifiable, measurable and does it correspond to the objectives

• Data and information processing
  => WHICH methods for measuring, analyzing and processing data should be used
  => HOW to use digital technologies in order to research and manage information

• Discussion of research results and conclusion
The management
Doctors/medical staff
Medical informaticians

degree of computerization

investment in ICT
Business Intelligence, BI

Business Intelligence in Telemedicine

Methodological Approach BI in Telemedicine

Conclusion
Conclusion:

„In healthcare, BI is one of the most important tools for managing medical data of all kinds: from electronic medical records to unstructured statistics from the Internet or patient information from IoMT (Internet of Medical Things).

There are no restrictions for business intelligence: data collection is possible from both healthcare providers and outside the institutions.

These data becomes the foundation for improved patient care, better treatment efficiency, reduced costs, and quick accreditation of healthcare services. And all of this is possible with the wide digital capabilities of BI systems.”

https://gloriumtech.com/healthcare-business-intelligence-bi-benefits-features/
Business intelligence represents a process of collecting available internal and significant _______ data and their conversion into useful information which improve ______ _______ process.

- top up -
Methodological Approach to Establishing Business Intelligence in Telemedicine
THANK YOU FOR YOUR TIME AND COOPERATION :) 
Keynote speaker - Assoc. Prof. Ljerka Luić

University North, Croatia