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Re-evaluating the Definition of Intelligence in Business Intelligence

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ABSTRACT

Objective – Business Intelligence has little bearing with graphs and dashboards of traditionally defined Business Intelligence. Rather it is all about experience and sound judgement of the person at the helm of the decision-making process. In line with this view, we evaluate and subsequently, reposition the current definition of Business Intelligence in the literature.

Methodology/Technique – The initial development of the data, information, knowledge and wisdom (DIKW) hierarchy excluded intelligence and so it never questioned the accepted definition of Business Intelligence. The extended DIKIW hierarchy includes intelligence but we raise the question about the definition of intelligence in Business Intelligence. This paper positions the existing definition of Business Intelligence as Business Information instead, and so, it redefines traditional Business Intelligence.

Findings – Applying the DIKIW hierarchy, the new definition of Business Intelligence is shown in equation as the transformation of "Business Data to Business Information to Business Knowledge to Business Intelligence to Business Wisdom".

Novelty – The impact of the new definition of Business Intelligence is that it changes its meaning from one that belongs to information science into one that is a human behavioural science and profiling concept. It does not do away with the existing work in literature but it redefines Business Intelligence as belonging to the realm of Business Information.

Type of Paper: Review

Keywords: Business Intelligence; DIKW hierarchy; DIKIW hierarchy; Knowledge Management; Wisdom.

JEL Classification: L25, M10.

1. Introduction

Business Intelligence (BI) is well described in academic literature. The body of knowledge was built on the first definition of Business Intelligence but the current definition of Business Intelligence is "Business Intelligence is a set of methodologies, processes, architectures and technologies that transform raw data into significant and useful information used to build perspectives and make efficient strategic, tactic and operational decisions" (Pop & Cristina-Loredana, 2013, p. 2). Using the current definition, we therefore aim to redefine Business Intelligence as the process of turning raw data into information.

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The narrower definition of BI refers to the reporting, analysis and dashboards of the BI architecture (Pop & Cristina-Loredana, 2013, p. 2). The narrower definition separates the areas of Information and Data Management from the definition of BI. The purpose of BI is to assist the organization defining strategies that can be implemented so as to improve performance. For the purpose of this article, the broader definition of BI is adopted. The time has come to reevaluate the initial definition as the body of knowledge has brought about more insights as is evident in the evolution of the DIKW hierarchy to the DIKIW hierarchy.

2. Research Problem

This article aims to find answers to the research questions by using the research method indicated. The following research questions have been identified:

RQ1: What are the differences, advantages and disadvantages between Business Information and Business Intelligence?
RQ2: To what extent does the DIKIW hierarchy redefine Business Intelligence as Business Information?
This article is part of a larger study which seeks to explore the definitive framework for Location-based Intelligence as defined by the DIKIW hierarchy. This article will use the descriptive phenomenological approach as a means to answer the questions posed. In essence, research is a systematic investigation that seeks answers to a problem (Blaxter et al., 2010). Penner and McClement (2008) recommend the use of a descriptive phenomenological approach when little is known about the topic under investigation. Location-based Intelligence is a fairly new field; there is a need to understand the lived experiences of users in the field. Panian published the first article in the World Academy of Science, Engineering and Technology journal in 2012. In this groundbreaking article, a framework was presented for Location Intelligence as a combination between Geolocation and Business Intelligence.

3. Method

3.1 The DIKIW hierarchy

The DIKW hierarchy defines the interrelationship of data, information, knowledge and wisdom. Figure 1 illustrates.

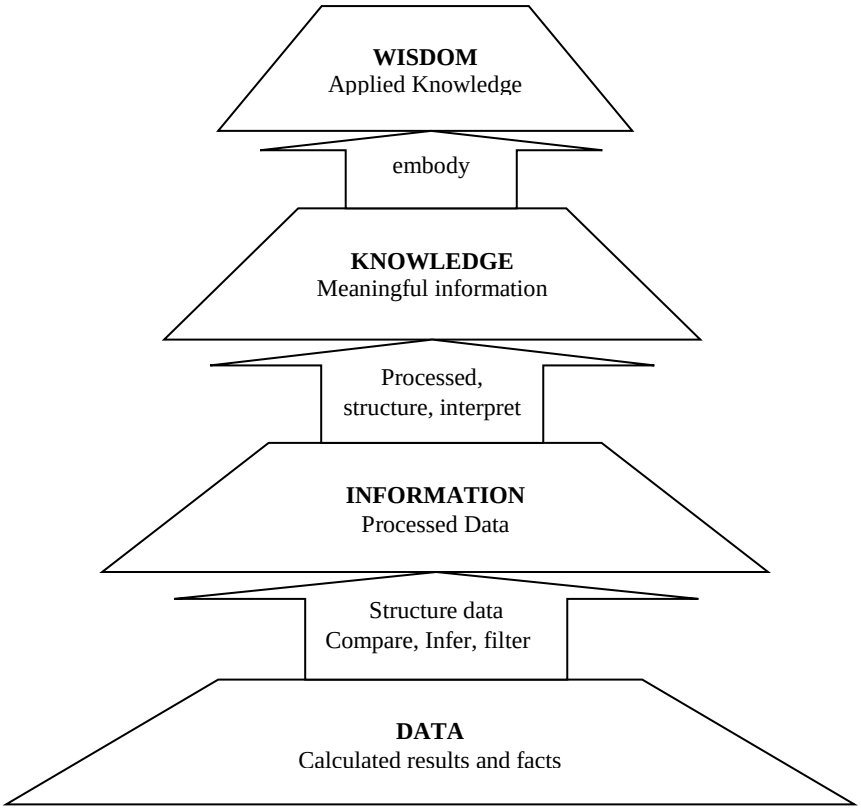

Figure 1. DIKW Hierarchy

Source: Mora et al., (2013, p. 18)

The DIKW hierarchy shows the increase in value for every level of the hierarchy. Raw data consist of calculated results and facts. When raw data are put into a structured format where comparisons, inferences and filtering can take place, they become information as the data have been processed. Information that is processed and interpreted becomes meaningful knowledge. This knowledge which is then applied by an experienced person becomes wisdom (Mora et al., 2013, p. 18).

The DIKW hierarchy already showed some differences with the broader definition of BI as mentioned earlier but it did not include the intelligence component. As a result, the broader definition of BI was not directly challenged by the DIKW hierarchy. The body of knowledge expanded the DIKW hierarchy to become the DIKIW hierarchy which occurred by including the intelligence component. Figure 2 demonstrates.

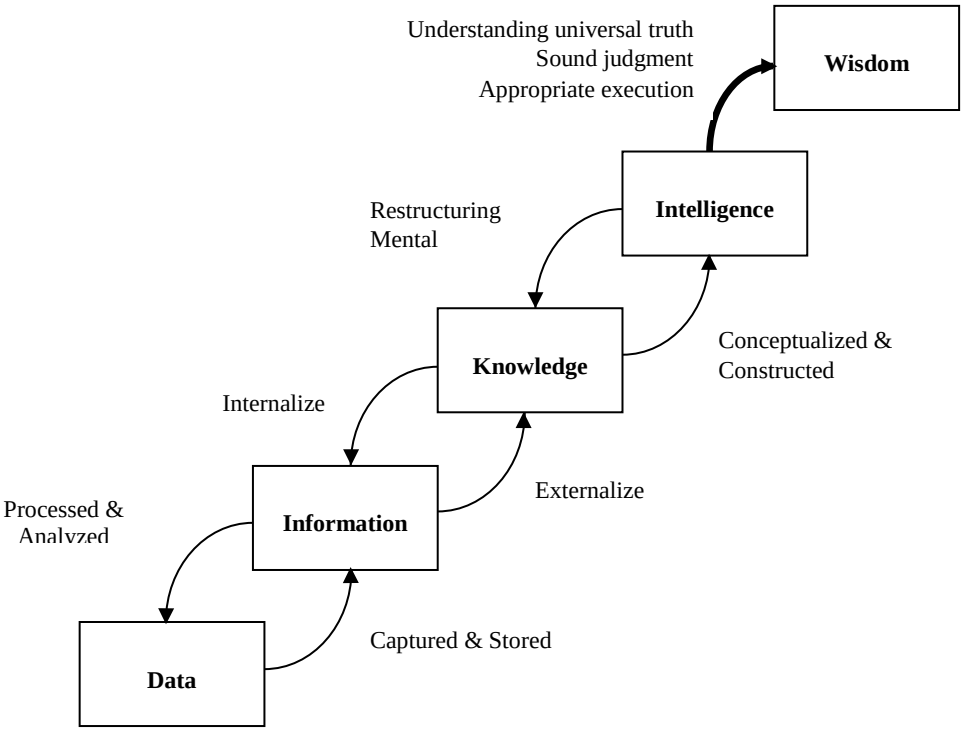

Figure 2. DIKIW Hierarchy

Source: Liew (2013, p. 49)

Intelligence, in the DIKIW hierarchy, is a refinement of the original wisdom in the DIKW hierarchy which defines intelligence as knowledge that has led to a restructuring of the mental processes of the individual. The intelligence that has been conceptualized and constructed enriches the knowledge. Wisdom is refined as intelligence that has been applied by an individual with an understanding of universal truths and sound judgement that leads to appropriate execution.

The DIKIW hierarchy challenges the existing definition of BI as the intelligence component has no bearing on graphs, pivots and dashboards as defined in the narrow definition of BI mentioned above. It requires the defining of the different components and practical examples can be sued to illustrate the different stages.

3.2. Describing Data of the DIKIW hierarchy

In the DIKIW hierarchy, data are raw facts which are stored in a data repository. Data can be stored in many forms: as facts in a database, file or Microsoft Office document. Data can also be stored as an unstructured media object such as video, images, news paperclips or sound recordings. In Example 1, product sales data are stored in a database relation consisting of the month, the product, the sales figure and the volume of units. The unique key of the data is the combination of the month and product data.

Raw Data

Month	Product	Sales (Rand)	Volume
Jan-2016	Cars	1 000 000.00	15
Jan-2016	Caravans	750 000.00	7
Feb-2016	Cars	900 000.00	12
Feb-2016	Caravans	700 000.00	6

March-2016	Cars	800 000.00	8
March-2016	Caravans	900 000.00	9

Example 1. Product sales data

3.3. Describing Information of the DIKIW hierarchy

Raw data that are processed and analyzed are transformed into information. The information results can be stored as raw data and then processed according to certain business rules. In Figure 2 of the DIKIW hierarchy the transformation process of data into information can be seen.

In Figure 3, the raw data of product sales in Example 1 are sorted into caravans and car sales. That information is presented in a summarized report and graph for caravans and car sales respectively.

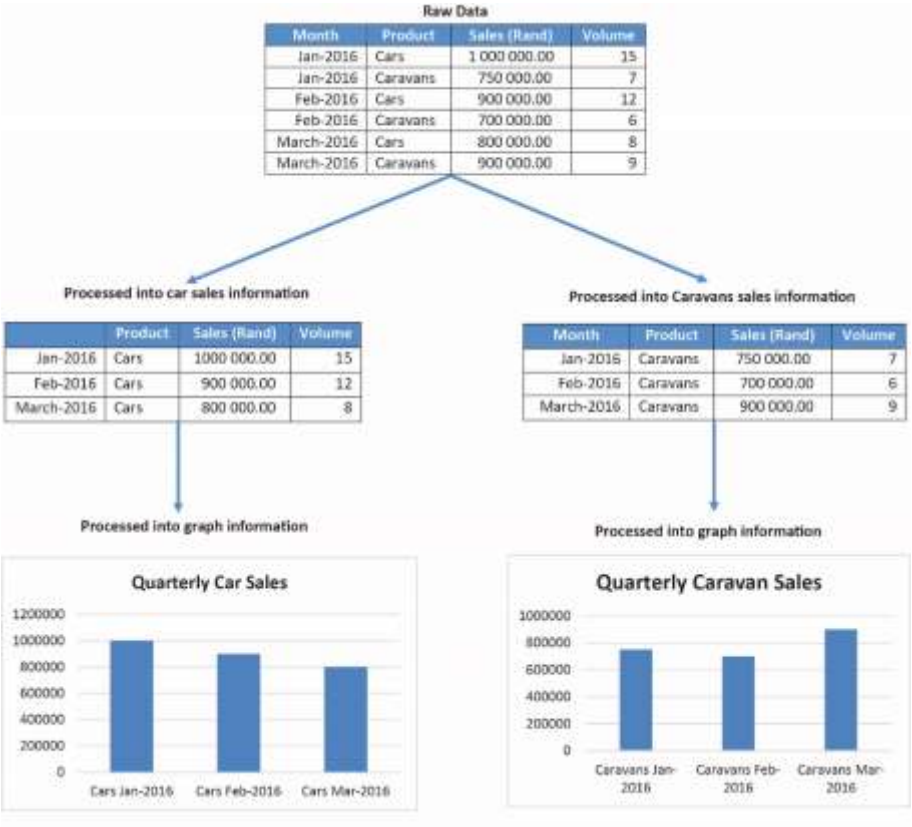

Figure 3. Data processed into information (data → information)

3.4. Describing Knowledge of the DIKIW hierarchy

Knowledge is simply actionable information (Tiwana, 2002, p. 37) and knowledge management is defined by Becerra-Fernandez and Sabherwal (2014, p. 18) as " performing the action to get the maximum value out of knowledge resources". This can be applied to an individual as well as an organization. Knowledge is formed from data that were turned into information.

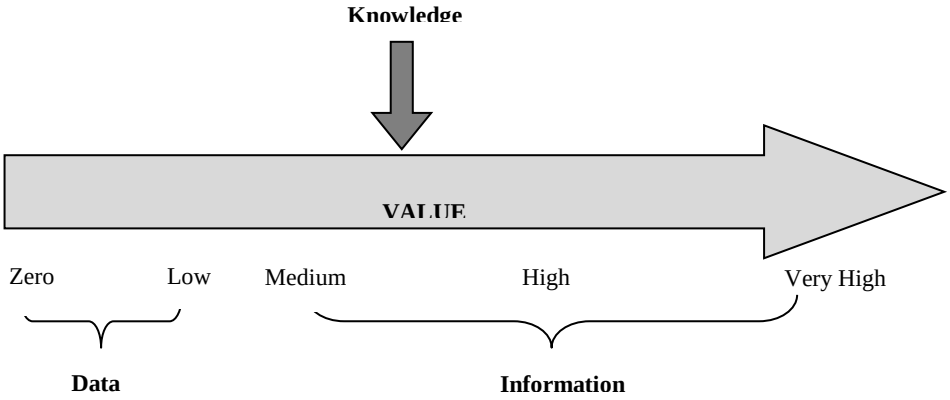

Figure 4. Relationship between Data, Information and Knowledge

Source: (Berecca-Fernandez & Sabherwal 2014, p. 38)

In the diagram, data are referred to as raw numbers and text that are devoid of meaning and context (Berecca-Fernandez & Sabherwal 2014, p. 36). Information is a subset of the data that have meaning and context (Berecca-Fernandez & Sabherwal 2014, p. 35). Knowledge is adding value to the information to make it more valuable to support decisions and events (Berecca-Fernandez & Sabherwal 2014, p. 38). In Figure 2 of the DIKIW hierarchy, it can be seen how information was transformed into knowledge.

In Figure 4, the business information has already been rendered the graphs in practical figures and the sales people will consult the business process diagram from the knowledge repository. This will guide the car and caravan sales persons on how to interpret the respective business information by following graph trends.

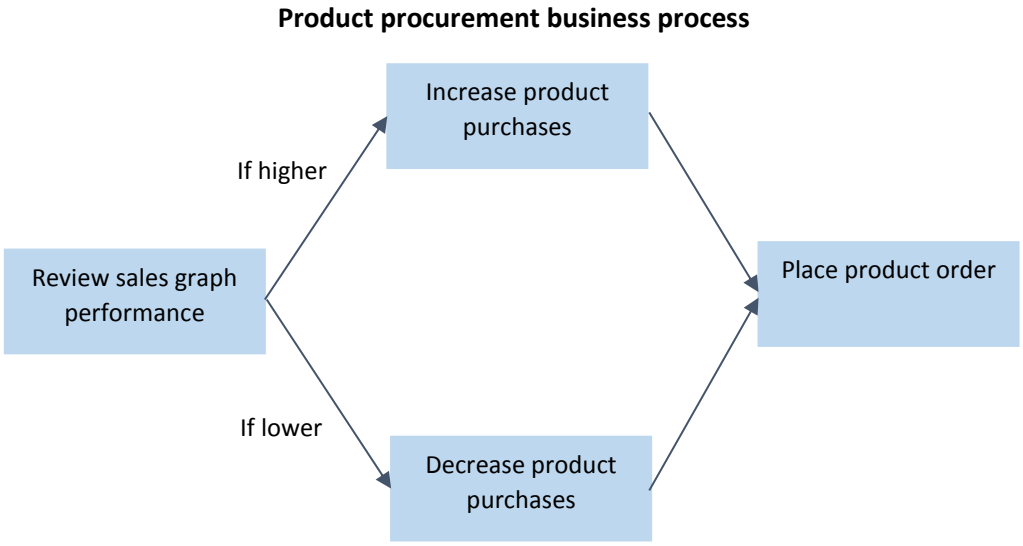

Figure 5. The business process in the knowledge repository

In Figure 5, based on the knowledge obtained from the business process guideline, the car sales person will decrease the car purchase for the next period and the caravan sales person will increase the caravan purchase.

3.5 Describing Intelligence of the DIKIW hierarchy

Intelligence has been added in the DIKIW hierarchy by expanding the wisdom component of the DIKW hierarchy. This is seen in Liew (2013, pp. 51-52) who recommends the different aspects of:

- Systems elements of intelligence,
- Theory of multiple intelligence,
- Concepts of intelligence,
- Theory of successful intelligence,
- Facets of implicit intelligence,
- Context of intelligence.

For the purpose of this article, the systems element of intelligence which seem most applicable for the definition of intelligence (Liew 2013, p. 51) is applied and they include:

- The monitoring of the internal and external state through sensory processing,
- The modeling of a subject having a best estimate, knowledge and simulation capability that generates expectations and predictions for planning and behavioural purpose,
- The value judgment as the basis for making decisions by differentiating between:
  - Good and bad,
  - Rewarding and punishing,
  - Important and trivial,
  - Certain and improbable and
- The behavior generation that selects plans, set goals and executes tasks,
- Context of intelligence.

In Figures 3 and 5, the different sales persons (caravan, car and management) will react differently to the knowledge information provided by the business process, based on their respective experiences. The knowledge repository shown in Figure 5 contains the following additional explanatory notes which are explained in Example 2.

Knowledge Repository Notes

Car Sales:

- Declines in the first quarter of the year after December holidays
- Increases in the second quarter of the year at the beginning of the new tax period
- Increases in the third quarter of the year
- Double increases in the last quarter of the year

Caravan sales:

- Decrease in the first quarter of the year after the holiday period
- Increase a month before the April holidays
- Decrease in the second quarter of the year
- Decrease in the third quarter of the year
- Double increases in the last quarter of the year before the December holiday

Example 2. Further information in the knowledge repository

The explanatory notes gained from the knowledge repository in Example 2 will be interpreted differently by each of the salespersons involved. This is explained in Table 5.

Table 5. Respective actions based on individual intelligence

Person	Experience	Intelligence in action
Sales person 1	The individual is working 6 month in the industry and 2 month in the company. The person is still learning the ways of the company.	The person interprets the sales graphs and recommend to order less car units and more caravan units for the next quarter. The person did not consult the knowledge repository.
Sales person 2	The individual is working 12 years in the industry and 2 month in the company. He is still learning the ways of the company	The person consult the knowledge repository and interprets the historical trends. The person recommends to keep the unit purchases the same for cars and caravans for the next quarter
Sales Manager	The individual is working 12 years in the industry and 12 years in the company. The person teaching the ways of the company.	The person is the author of the notes in the knowledge repository and knows the historical trends. The person recommends to increase unit purchases for cars and decrease the units for caravans for the next quarter

3.6. Describing Wisdom of the DIKIW hierarchy

The purpose of the DIKIW hierarchy is to work towards a systematic approach of wisdom that benefits all its participants (Jaimini & Panchal, 2014, p. 56). There are already many examples of technology that can automate data, information and knowledge all of which aim to extend the body of knowledge towards intelligence and wisdom. Jaimini and Panchal (2014, p. 56) simplifies the DIKIW hierarchy to the following equation:

$$Wisdom = Data + Information + Knowledge + Intelligence \quad (1)$$

In the above equation (1), the "+" sign is problematic as it can be interpreted as a mathematical operator. The researcher recommends the use of the "→" sign to indicate a transformation process. The equation therefore, should be:

$$Wisdom = Data \rightarrow Information \rightarrow Knowledge \rightarrow Intelligence \quad (2)$$

In equation (2), the following interpretations are provided:

- Data = a set of objects with understandable meaning,
- Information = interpretation of data according to predefined rules,
- Knowledge = data and information,
- Intelligence = knowledge and grasping ability,
- Wisdom = intelligence added with practical experiences.

In Table 6, the different sales people who are listed in Table 5 will react differently with their intelligence and practical wisdom.

Table 6. Respective actions based on individual wisdom

Person	Experience	Intelligence in action	Wisdom in action
Sales person 1	6 month in the industry and 2 month in the company	The person interprets the sales graphs and recommend to order less car units and more caravan units for the next quarter. The person did not consult the knowledge repository.	The person differs from the purchase actions and resigns out of protest
Sales person 2	12 years in the industry and 2 month in the company	The person consult the knowledge repository and interprets the historical trends. The person recommends to keep the unit purchases the same for cars and caravans for the next quarter	The person is puzzled by the purchase actions and set up a meeting with the sales manager to seek understanding
Sales Manager	12 years in the industry and 12 years in the company	The person is the author of the notes in the knowledge repository and knows the historical trends. The person recommends to increase unit purchases for cars and decrease the units for caravans for the next quarter	The person agrees to the meeting request of the one and refuse the resignation letter of the other. The manager sends the inexperienced person for anger management classes

3.7 The current definition of Business Intelligence

AS stated above, the broad definition of Business Intelligence is ”Business Intelligence is a set of methodologies, processes, architectures and technologies that transform raw data into significant and useful information used to build perspectives and make efficient strategic, tactic and operational decisions” (Pop & Cristina-Loredana 2013: 2). The equation of the current definition is:

$$Data \rightarrow Intelligence \tag{3}$$

Using the broad definition, the current definition will thus define Business Intelligence as the process of turning raw data into information. In the DIKIW hierarchy, this falls into the realm of information (Jaimini & Panchal 2014: 54) therefore, the equation should be:

$$Data \rightarrow Information \rightarrow Knowledge \rightarrow Intelligence \tag{4}$$

Comparing the difference between equation (3) and equation (4), it can be clearly seen that there is a need to redefine Business Intelligence as *Business Information*.

3.8 Redefining Business Intelligence as Business Information

Using the DIKIW hierarchy, the proper definition of Business Intelligence should therefore, be *Business Information*. In this regard, the definition of Business Information can therefore, be defined as “*Business Information* is a set of methodologies, processes, architectures and technologies that transform raw data into

significant and useful information which are used to build perspectives and make efficient strategic, tactic and operational decisions".

3.9 A new definition for Business Intelligence

In the simple equation provided by Jaimini and Panchal (2014, p. 54) Business Intelligence can be defined as:

Business Intelligence = Business Data → Business Information → Business Knowledge (5)

Equation (5), however, has the following components:

- Business Data = a set of objects with understandable meaning
- Business Information = interpretation of data according to predefined rules
- Business Knowledge = data and information

Adapting the DIKIW hierarchy (Liew, 2013, p. 49) for all aspects of Business so as to provide a clearer perspective of Business Intelligence, Figure 6 is presented.

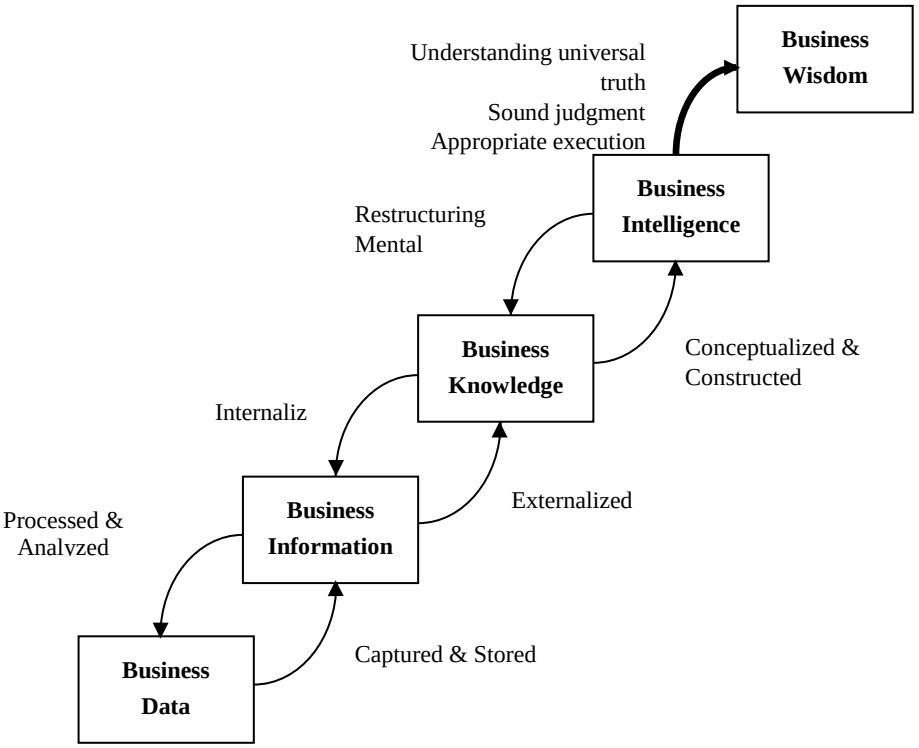

Figure 6. Adapted DIKIW hierarchy for Business Intelligence
Source: Researcher's own construct

4. Results and Discussion

The DIKIW hierarchy has a high level equation of the interrelationship of data, information, knowledge, intelligence and wisdom. This is represented in equation (2) which shows the transformation of "Data to Information, Information to Knowledge, Knowledge to Intelligence and finally, Intelligence to Wisdom". The

traditional definition of Business Intelligence, according to the DIKW hierarchy, is seen in equation (3) as the transformation of "Data into Intelligence". This is compared to the more complete equation (4) which shows the transformation of "Data to Information, Information to Knowledge, Knowledge to Intelligence". This process shows that the current definition of Business Intelligence should be *Business Information*. This is seen in equation (5) which shows the transformation of "Business Data to Business Information to Business Knowledge to Business Intelligence to Business Wisdom". This has been illustrated in Example 1 through Table 5.

5. Future Work

Location Intelligence in the above section was defined as the combination of Geolocation and BI. Following that it was mentioned that the DIKIW hierarchy provides the same framework which can redefine Geolocation Intelligence into *Geolocation Information* a redefinition that is similar to the redefinition of Business Intelligence into *Business Information* as elaborated in this article. The equations for *Geolocation Information* and *Location Information* would thus bear a similar explanation. The transformation process of each component of the equation can be further expanded.

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