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***Title of Paper***

***Investing Statistical Knowledge – A Road to Sustainable Statistical Literacy***

**Abstract**

For BPS, promoting statistics is not only exposing the variant of outputs, but also the formation and possible utilization of those products. Therefore, BPS is ambitiously providing people with a comprehensive statistical understanding package. BPS is being so pushful on this matter because the prospect occurrence of statistical fallacy is unavoidable. As anticipation steps, BPS used to conduct seminar, training, workshop, and e-learning. Later, BPS conducted an initiative, exploiting comics for arousing people’s interest to learn statistics of their own volition.

BPS introduced comics for understanding seasonal adjustment figures in 2018. This comics was proved as an effective tool to increase user’s awareness. The utilization of Bureaucratic Reform Facebook fan page as mean of dissemination, also hold a power of enforcement for BPS’ intern side. This success could be traced through a paper entitled “Comics for Statistical Literacy-Understanding Seasonal Adjustment Figures”.

Does not want to stop in this point, BPS created Co-Mistique, special comics for conceiving statistical philosophy. “Understanding Statistics from The Root” is the main objective. The latest topics appointed in Co-Mistique are Grasping Price & Inflation Statistics and BPS for Sustainable Development Goals. Both will be described in this paper.

Currently, BPS is broadening comics dissemination methods. First, dissemination through BPS’ official social media accounts (Facebook, Twitter, and Instagram) maintained by Public

Relation Division. These accounts are connected with social media accounts of all ministries and most government agencies. Second, dissemination through social media accounts owned by BPS' stars with considerable number of followers. Sure, these approaches would encourage people from BPS' extern side. All these effort will be described in the paper. BPS wishes this new fashion of statistical education will contribute to the sustainable statistical literacy.

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## **II. Introduction**

Promoting statistics is an essential way show credibility of National Statistical Office (NSO) and seriousness in serving statistics users. Statistics play an essential role as government policy's evidence base. Keen understanding about statistics used in government policy is greatly influential in public trust formation. Statistical and critical thinking should be encouraged to users over time in order to impede the occurrence of statistical fallacy.

Statistical fallacy often happened as a consequence form lack of technical knowledge. It could be in the forms of misuse, misinterpretation, misconception or incorrect reasoning. NSO should find effective manners to provide users with a comprehensive statistical concepts. In this case, NSO hold missions as statistics producer and teacher at once. Based on the experience of seasonal adjustment promotion, comics are still considered as breakthrough strategy for statistical literacy.

Co-Mistique is a configuration of BPS' commitment in employing comics for literacy purpose. Co-Mistique is design to arouse people's interest to learn statistics without distress and burden. The engagement of Co-Mistique with various social media as means of dissemination would contribute to sustainable statistical literacy.

## **III. A Road to Sustainable Statistical Literacy**

### **A. Statistical Fallacy Prone to Occur**

Statistics is often called as study of the laws of chance as it is a method of learning from experience and decision making under uncertainty (Chakrabarty, 2012). Chance is inherent in all natural phenomena. Statistics tries to quantify the natural behaviour of phenomena by number and analyze using scientific methods. Bhalerao (2011) explained that statistics hold a status as science and arts together. It is a science because its methods are basically systematic and have general application. As an arts, statistics suscessful application depends on a considerable degree on the skill and the special experience of a statistician. The art of statistics that often lead to statistical fallacy occurrence, either regard to misuse or misinterpretation.

Robust statistics are essential for drawing up evidence base to underpin all public policy (House of Commons, 2013). Public trust in government policy will be more likely if the public understand the evidence base and the statistics used. Therefore, communicating statistics effectively becomes an important step to uphold institutional accountability.

Communicating statistics is a mandatory obligation for NSO regarding tranparency issue or data statistics access openness. Furthermore, a standard legal education does not include rigorous training in statistics or the evaluation of scientific evidence (Enos, Fowler and Havasy, 2017). Then the communication should be conducted seriously, with clear and helpful explaining principles, as the users and

stakeholders of statistics are wide and diverse. Otherwise, statistical fallacies are inevitable, even to expert users groups.

Klass clarified that statistical fallacies occur when an argument's conclusion are not supported by the numerical evidence provided as premises. Briggs (2014) released simple statement, when a statistics are not what you think then they are fallacy. It could happen because of lack of technical knowledge, the use of unsuitable test of significance or even unsuitable data (Bhalerao, 2011). Moreover, biased opinions and perception of investigators and not remembering limitations while analyzing and interpreting any data and problem would also cause fallacies.

Statistical misuse, misinterpretation, misconception, incorrect reasoning are all considered as statistical fallacies. Imposing new fashion of statistical literacy would mitigate the probability of its occurrence. Fundamental of statistics should be considered as important in order to strengthen users's statistical understanding (Garfield, 1995). Comics as statistical delivery tools can be a breakthrough in statistical literacy program.

## **B. Comics in Literacy Program**

Statistical literacy is broadly define as the ability to interpret, critically evaluate, and express one's opinions about statistical information and data-based message (Gal, 2003). Gal (2002) also denoted there are two interrelated components of statistical literacy, knowledge and disposition components. An assumption made by Gal that knowledge bases for statistically literate behavior are literacy, statistical, mathematical, world, and critical. Meanwhile, disposition component is related to involving critical stance, beliefs, and attitude.

An issue on statistical literacy highlighted by UNECE (2012) is transparency. It is a keyword in how to help people (users) to understand the data. The better people are informed about how to evaluate figures and the reliability of statistics, the easier they can assess the meaning and quality of the data. According to Schield (2013), when one misreads the meaning of statistical claims, it is most tempting to say that statistics lie. Analytical and critical thinking about statistics are therefore necessarily to be build. Versaci (2001) mentioned that both skills can be developed through comics.

Comic is a sequential art (Eisner, 1985) that integrate visual and verbal communication simultaneously (Combs, 2003). Bolton-Gary (2012) claimed that linking concepts with pictures, such as comics, enable learner to construct knowledge in more than one modality. Moreover, they are also engaged in high level language modalities when comics are employed in the classroom as second learning language (Clydesdale).

The vividness of comics helps conveying impactful messages with strong story telling (McGrail and Rieger, 2013). Sones (1944) stated that comics employ a language that apparently is almost universally understood. No wonder if comics could

attract reluctant readers (Baker 2011). Marianthy, Boloudakis and Retalis (2008) have made a summary about the strength of comics in literacy program from various sources, i.e.:

1. **Motivating**  
As human tend to have natural attraction to picture, comic can capture and maintain the learner's interest.
2. **Visual**  
Pictures and text that mutually tell a story would result in emotional connection between learners and characters of a comics' story.
3. **Permanent**  
Comics' permanent visual components would help learners to follow the story step by step and can be hold anytime in the part of interest.
4. **Intermediary**  
Comics can scaffold to difficult disciplines and concept, can give reluctant readers the non-threatening practice.
5. **Popular**  
Comics have gained its fame as edutainer since long time ago. It brings education and entertainment together.
6. **Development of thinking skills**  
Comics would force learners to get familiarized with these two means of expression, uncovering the deeper meaning of a work and offering a profound insight.

### **C. Co-Mistique for Investing Statistical Knowledge**

BPS has hired comics for promoting various statistical products and activities. But, performing comics for conceiving statistics philosophically has just started in 2018. The initial project was Seasonal Adjustment Comics. Writers have proven that comics are effective tools to elevate statistical public awareness (Yuniarti and Faris, 2018). This success can be traced through research paper entitled "Comics for Statistics Literacy – Understanding Seasonal Adjustment Figures".

Within 2 weeks release in Facebook, seasonal adjustment comics have reached more than 5500 people. The statistics of users also revealed that comics have met its target users as 67% of them are aged 18-34 years. Positive responses and comments from users have reasserted comics as a breakthrough strategy of statistical literacy. The seasonal adjustment comics snippet is presented in figure 1.

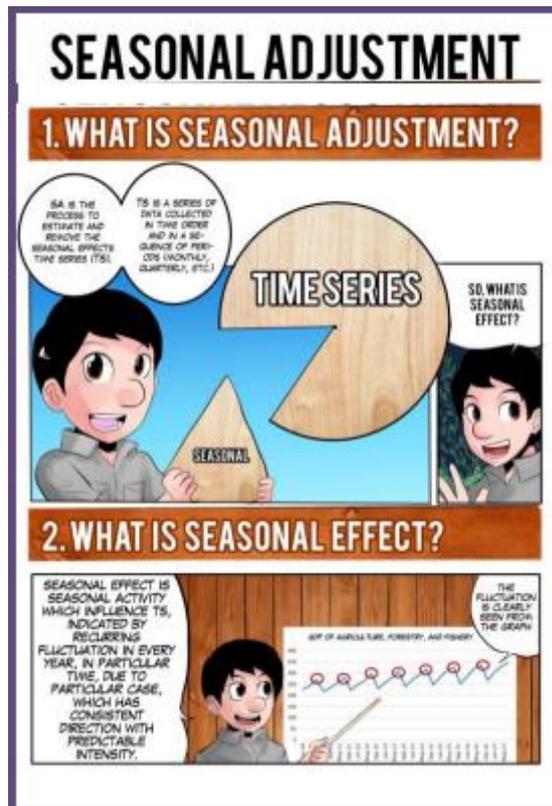


Figure 1. Seasonal Adjustment Comic Part 1 and 2

The real success of literacy projects are when its sustainability is preserved. BPS does not want to stop with just seasonal adjustment comics. Greater project on statistical literacy has been established called “**Co-Mistique**”. It is a continuation of seasonal adjustment comics.

Co-Mistique is a dedicated comics’ vessel which contain various statistical comics and aims to awaken people’s interest to learn statistics of their own volition. After it was set up officially, seasonal adjustment comics then included as first member. Bringing a spirit “Understanding Statistics from The Root”, Co-Mistique would serve public with statistical philosophy easy understanding. The most recent statistical works on behalf of Co-Mistique have taken topics “Grasping Price & Inflation Statistics” and “BPS for Sustainable Development Goals”. The first page snippets of both are presented in figure 2 and figure 3. Meanwhile, whole comics are provided completely in Appendix 1 and Appendix 2 respectively.

# PRICE & INFLATION STATISTICS

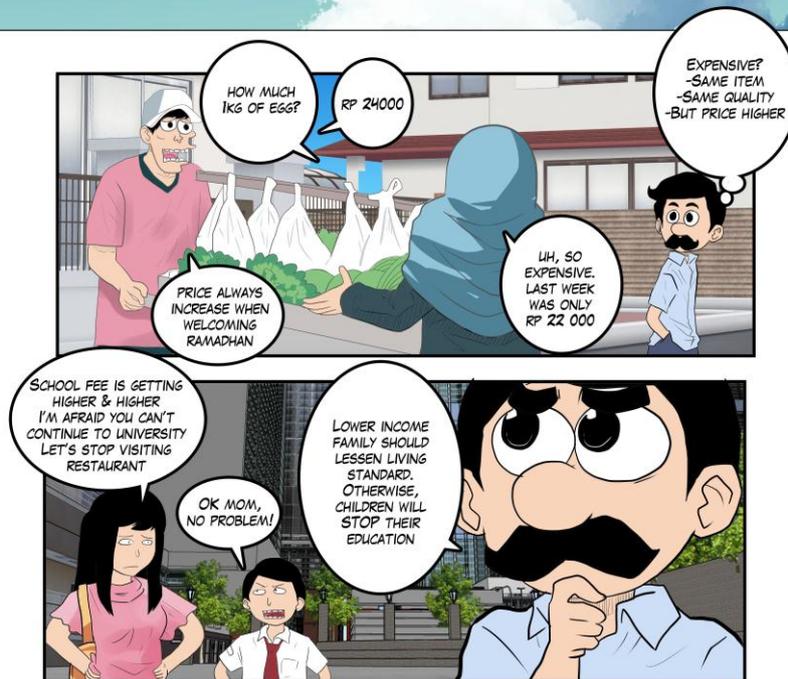


Figure 2. Grasping Price & Inflation Statistic-First Page

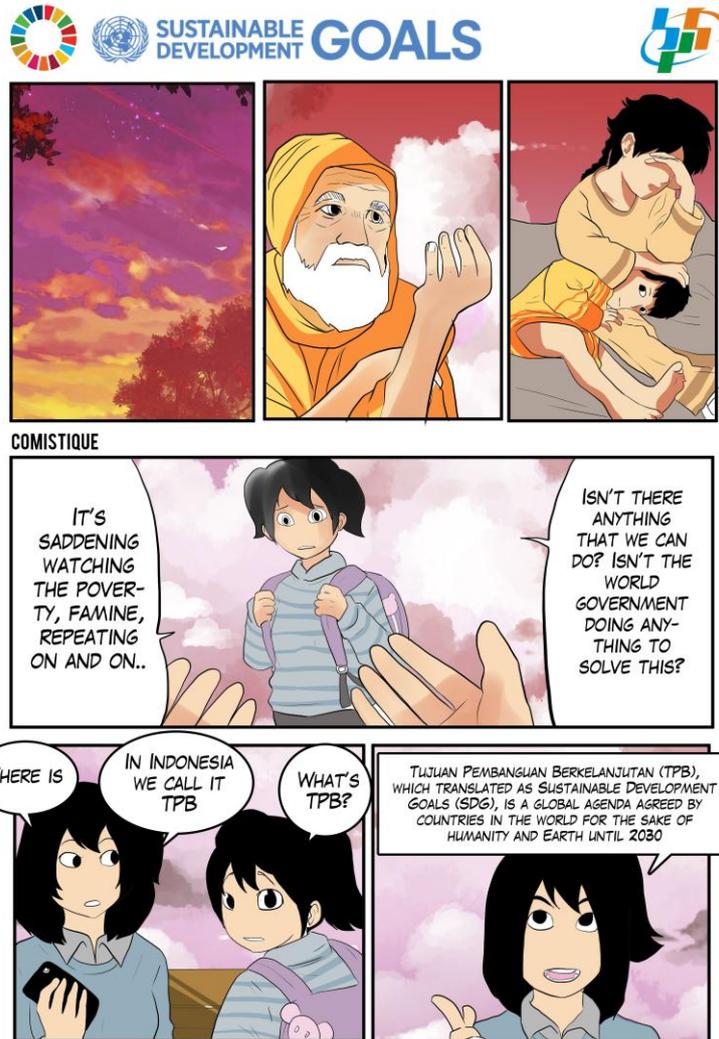


Figure 3.BPS for Sustainable Development Goals -First Page

#### D. Comics Dissemination Manner

Seasonal adjustment comics were disseminated through Facebook in collaboration with BPS' Bureaucratic Reform program. The implementation of Bureaucratic Reform programs are considered as powerful vehicles to promote new product of changing, as it covers a lot of aspects of official reformation and has power of enforcement. Facebook as part of social media provides power to share, make the world more open and connected with each other (Raut and Patil, 2016).

After establishing Co-Mistique, BPS broadens comics' dissemination methods as the extension of the former method. First, dissemination through BPS' official social media accounts (Facebook, Twitter, and Instagram) maintained by Public

Relation Division. These accounts are connected with social media accounts of all ministries and most government agencies. Second, dissemination through social media accounts by owned BPS' stars with considerable number of followers. These approaches would encourage users from BPS' extern side.

## E. Users' Judgement

The effectiveness of comics in statistical literacy could not be denied. Seasonal adjustment comics have proven it beforehand. At the moment, Co-Mistique that bring topics on grasping price and inflation statistics and BPS for Sustainable Development Goals also showed the equal success. Comics have reached 1,063 users through Facebook account within 4 hours, more than 17,800 users through Instagram account within 9 hours, and many more from Twitter.

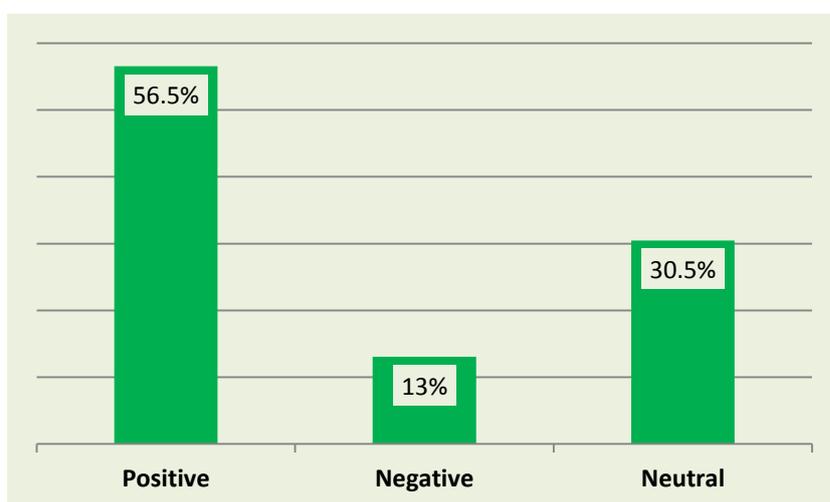


Figure 4. Sentimen Analysis Result

A lot of users have delivered their tough about comics in respective social media. About 57% of users submitted positive opinion as the comics is useful for them. But, there are 13% percent of them who expressed negative sentiment. They argued that comics packed in Co-Mistique still hire many words and are less of humor.

Nowadays, comics for promoting statistics philosophically are still a rare case. People with positive opinion have given full support to conduct statistical literacy using comics. Comics could help lessen the burden in statistics learning.

## IV. Conclusion

Many people unconsciously using statistics in their daily life, but they often say that statistics is tough. When statistical claim is different with what we think, than statistics is a medium of lie. Statistics can be useful and dangerous at the same time depends on how we perform it. If we perform it in incorrect way, statistics fallacy is inevitable. Statistician should take action to make statistics well treated.

Comics have become BPS' choice to provide people a better understanding about statistics. Statistics production is revealed through a sequence of story that easy to adhere. The fact that comics are appealing and attractive has promoted statistical insight to broader users. Public have discovered a new way to document vision and thought. Statistics also has become less threatening and encouraged a critical thinking. Sure, BPS will keep moving with comics for statistical literacy. Because educating people with statistical philosophy is a kind of investment. Comics engaged with various social media will contribute to sustainable statistical literacy.

BPS had defined targeted users when set up statistical comics. People aged at least 17 years old are considered as potential comics' users. People in this age group segment are assumed to have mature behavior and critical thinking. BPS treats them as objects of advance statistical literacy who can comprehend various statistical concepts easily through comics. Figure 5 is statistics of users released by Facebook. It has proven that BPS' comics have met the targeted users.

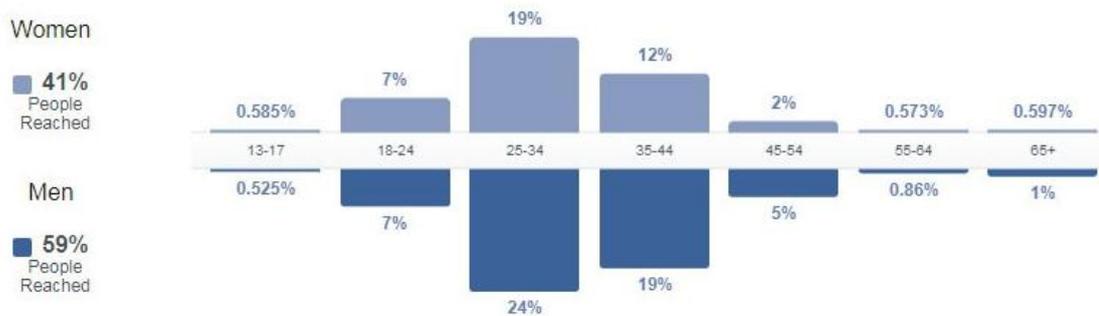


Figure 5. Statistics of Users by Age Group (released by Facebook)

Ferligoj (2015) mentioned that statistical office is one of important actor that should contribute to statistical literacy. Training and workshop are traditional forms of literacy technique. Both are able to cover limited number of people only. Considerable budget is also required to ensure the implementation. Comics joined with social media can be a reasonable solution to reach many more people within short time and reduce cost for training and workshop when budget availability is closely limited. Other NSO can also examine this approach as BPS has proven the success of this strategy.

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