Adaptation of Knowledge Management on Preventive Catastrophic Waste Slide

https://mgronline.com/qol/images/2013/3/original/58c61bd2c36188986c8b462a.jpg
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Jun 02, 2017

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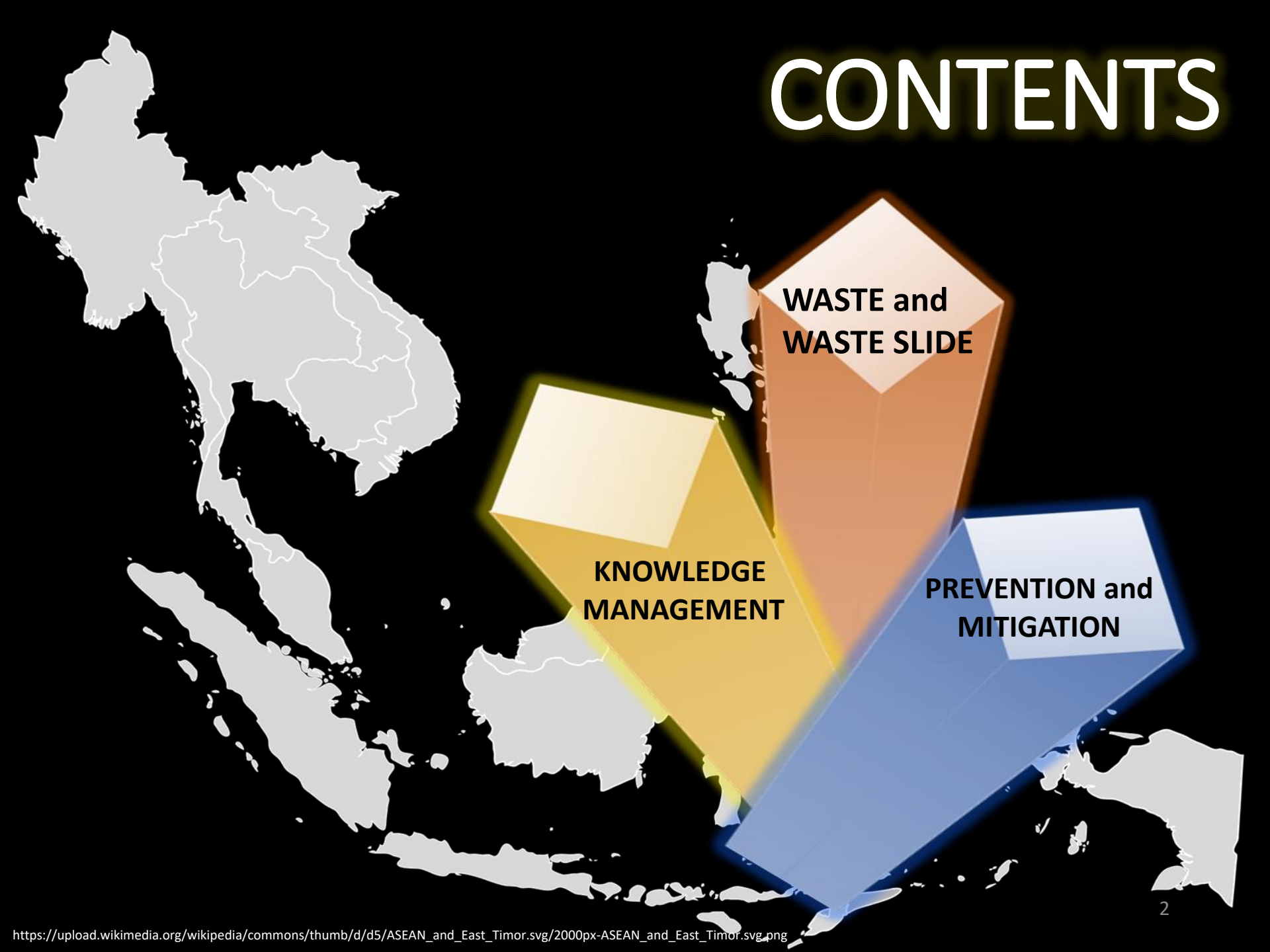

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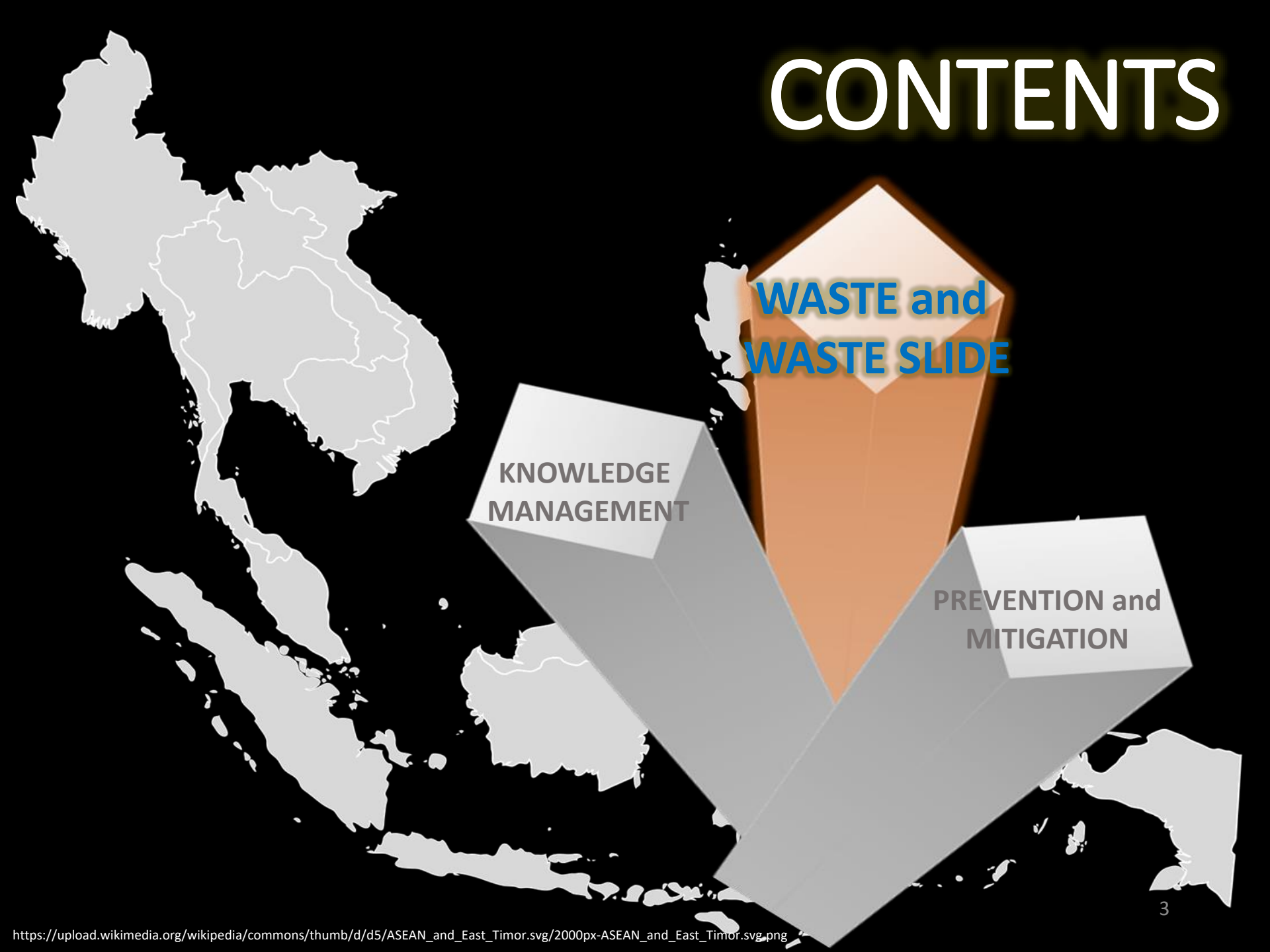

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CURRENT SITUATION OF MUNICIPAL SOLID WASTE

Worldwide, approximately **1.3 billion tons** of MSW are generated per year, and this number is expected to reach **2.2 billion tons by 2025**.

https://upload.wikimedia.org/wikipedia/commons/thumb/d/d5/ASEAN_and_East_Timor.svg/2000px-ASEAN_and_East_Timor.svg.png; http://simplyrecycleschools.ca/png/garbage-pile-fg.png; Hoornweg, D. and Tata, P.B. (2012). What a waste – A global review of solid waste management urban development & local government unit. World Bank, Washington, DC, 2012.

CURRENT SITUATION OF MUNICIPAL SOLID WASTE

On a daily basis of urban areas in **Asia**,

it is expected that **1.8 million tons** of waste will have been generated by2025.

Especially in developing countries, the large excess of waste generated in cities is a result of **population growth** and **economic development**.

http://www.worldatlas.com/aatlas/wrldnanb.htm; http://simplyrecycleschools.ca/png/garbage-pile-fg.png; Hoornweg, D. and Tata, P.B. (2012). What a waste – A global review of solid waste management urban development & local government unit. World Bank, Washington, DC, 2012.

CURRENT SITUATION OF MUNICIPAL SOLID WASTE (cont.)

Myanmar

- 2 m. tons/year
- Dumps and landfills
- Organic 54%, Plastic 16%

Thailand

- 14 m. tons/year
- Dumps and landfills
- Organic 48%, Paper 15%, Plastic 14%

Cambodia

- 7 m. tons/year
- Dumps and landfills
- Organic 55%, Plastic 10%

Singapore

- 3 m. tons/year
- Recycling and incineration
- Organic 44%, Paper 28%, Plastic 12%

Indonesia

- 23 m. tons/year
- Dumps and landfills
- Organic 62%, Plastic 10%

Vietnam

- 15 m. tons/year
- Dumps and landfills
- Organic 48%, Paper 15%, Plastic 14%

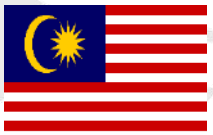
Laos

- 0.5 m. tons/year
- Dumps and landfills
- Organic 46%, Metal 12%, Plastic 10%

Philippines

- 11 m. tons/year
- Dumps and landfills
- Organic 41%, Paper 19%, Plastic 14%

Malaysia



- 8 m. tons/year
- Dumps, landfills, incineration
- Organic 62%, Plastic 12%

Brunei

- 0.2 m. tons/year
- Landfills
- Organic 44%, Paper 22%

World Bank, What a waste 2012; http://economists-pick-research.hktdc.com/resources/MI_Portal/Article/rp/2015/07/470554/1437641013270_SEAsiaProduction1_470554.jpg; http://www.xn--12cg1cxchd0a2gzc1c5d5a.net/wp-content/uploads/2014/09/asean.png

CURRENT SITUATION OF MUNICIPAL SOLID WASTE (cont.)

Total generated waste

> 83 m. tons/year

71 m. tons is from Thailand, Indonesia, Vietnam, Philippines, and Malaysia

Disposal methods

Dumps and landfills

Main composition of waste

Organic and plastic

http://economists-pick-research.hktdc.com/resources/MI_Portal/Article/rp/2015/07/470554/1437641013270_SEAsiaProduction1_470554.jpg; http://www.xn--12cg1cxchd0a2gzc1c5d5a.net/wp-content/uploads/2014/09/asean.png

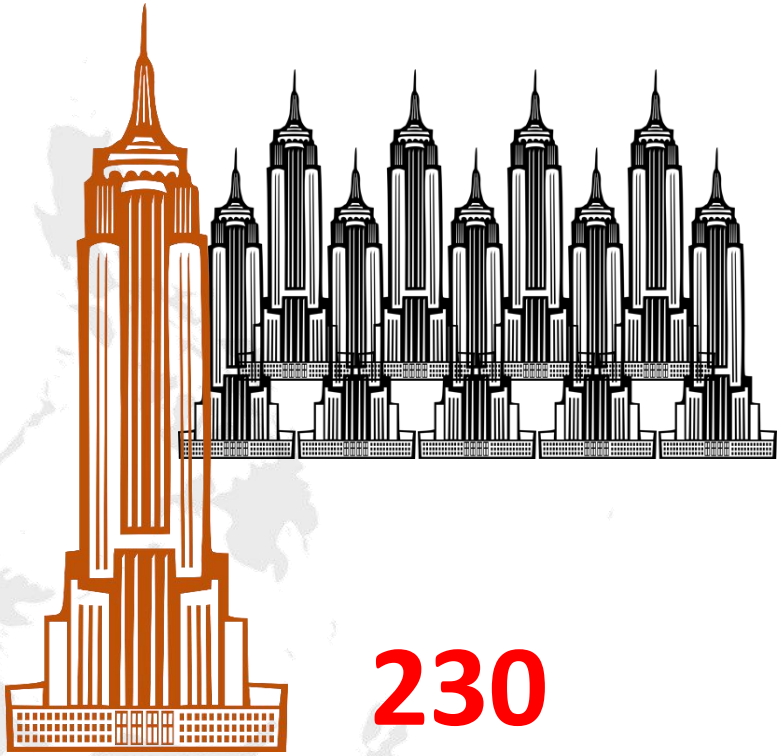
CURRENT SITUATION OF MUNICIPAL SOLID WASTE (cont.)

> 83 m. tons/year

336,000

Boeing 777 aircrafts

* One aircraft is about 250 tons



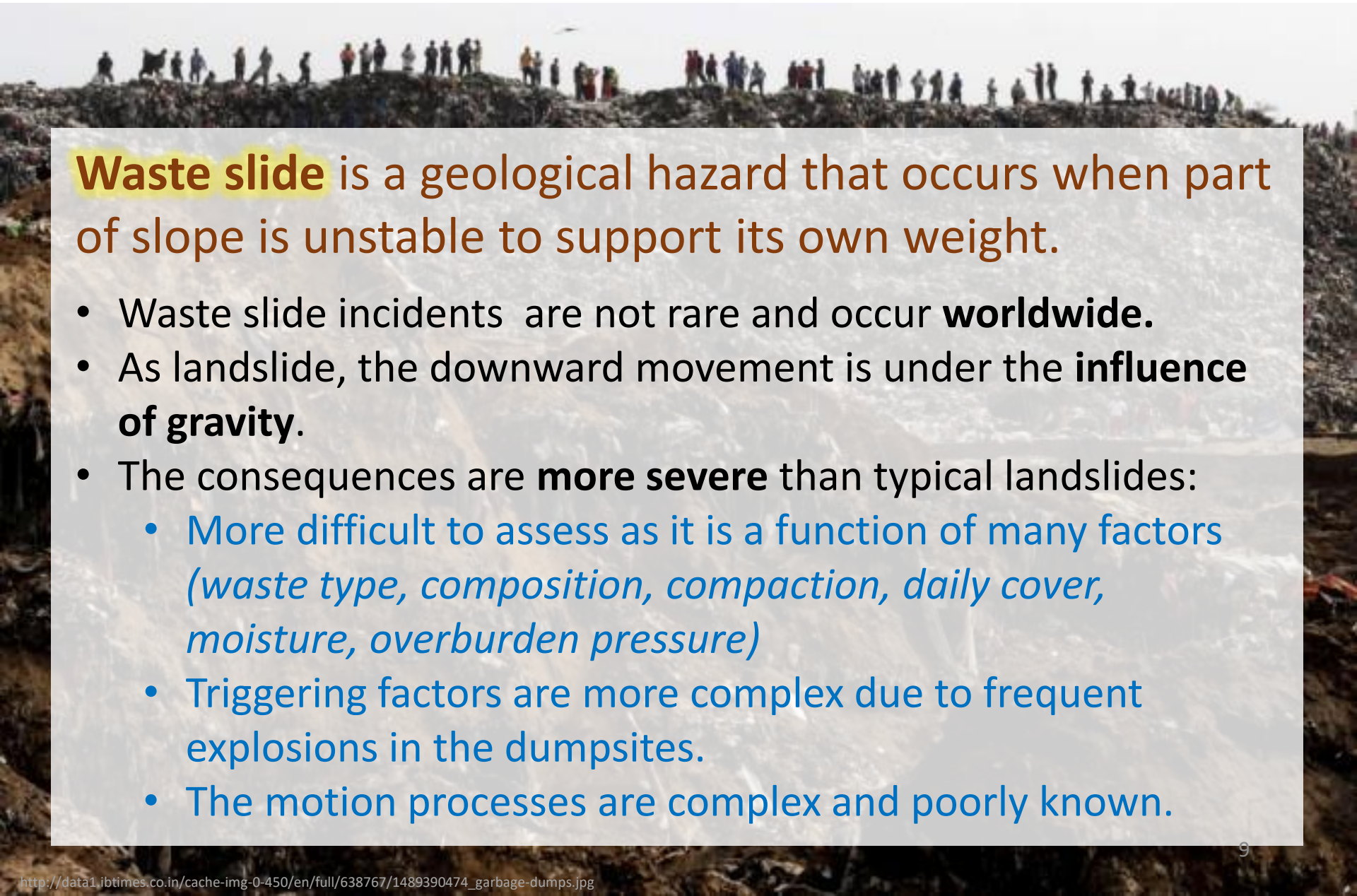
230

Empire State buildings

* The building is 365,000 tons

http://rogersonaircraftequipmentgroup.com/wp-content/uploads/2015/05/Boeing_777.png http://www.stickpng.com/img/world-landmarks/new-york/art-deco-empire-state-building

WASTE SLIDE



Waste slide is a geological hazard that occurs when part of slope is unstable to support its own weight.

- Waste slide incidents are not rare and occur **worldwide.**
- As landslide, the downward movement is under the **influence of gravity**.
- The consequences are **more severe** than typical landslides:
  - More difficult to assess as it is a function of many factors *(waste type, composition, compaction, daily cover, moisture, overburden pressure)*
  - Triggering factors are more complex due to frequent explosions in the dumpsites.
  - The motion processes are complex and poorly known.

http://data1.ibtimes.co.in/cache-img-0-450/en/full/638767/1489390474_garbage-dumps.jpg

WASTE SLIDE (cont.)

Causes of waste slide

Same as landslides, waste slide is triggered by **both natural and human induced causes**.

- **Natural induced causes**
  - **Climate**: intense rainfall, temperature
  - **Geological**: susceptible materials (soil and rock types), seismic, fault
- **Human induced causes**
  - **Poor infrastructure at dumpsites:** no drainage system, poor piping system
  - **Poor landfill management:** excess and uncontrolled dumping, high vibration, excessive height and slope
  - **No waste separation**: mixed of waste (hazardous, infectious, organic, inorganic)

http://blogs.agu.org/landslideblog/files/2011/05/11_05_08-garbage-1.jpg

WASTE SLIDE (cont.)

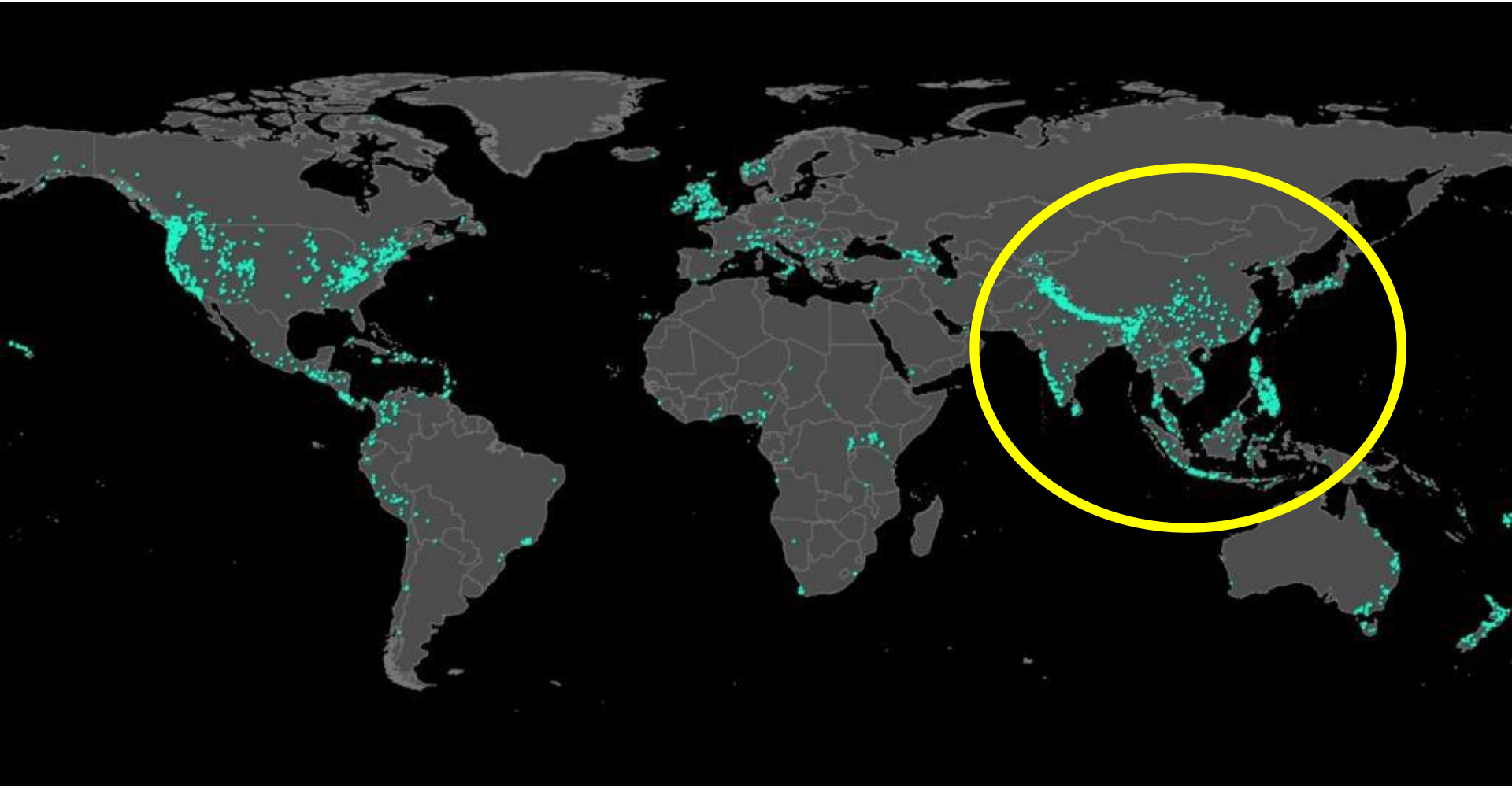
Documented waste slide incidents

Date	Location	Country	Death toll	Causes of slope failure
Mar 1988	Kettleman, California	USA	-	Excess pore water pressure
Jun 1991	Bandeirantes, Sao Paulo	Brazil	-	Heavy rainfall
Mar 1992	Belo Horizonte	Brazil	>100	Heavy rainfall
Apr 1993	Umraniye-Hekimbasi, Istanbul	Turkey	39	Gas explosion
Apr 1993	Istanbul	Turkey	39	Gas explosion
Mar 1996	Rumpke, Cincinnati, Ohio	USA	0	Excavate and explosion
Sep 1997	Dona Juana, Bogota	Colombia	0	Pore pressure by leachate
Jul 2000	Payatas, Manila	Philippines	278	Heavy rainfall (Typhoon)
Jun 2002	Chongqing	China	10	
Oct 2005	Shanglue City, Shaanxi	China	13	
Mar 2003	Athens	Greece	0	Fire and water
Feb 2005	Leuwigajah, Bandung	Indonesia	147	Fire and heavy rain
Oct 2005	Bello, Medellin	Colombia	43	Heavy rainfall
Jun 2008	Guatemala City	Guatemala	50	Gas and rainfall
Dec 2015	Shenzhen, Guangdong	China	77	Excess pressure from collapsed waste
Mar 2017	Addis Ababa	Ethiopia	113	Excess pressure on the hillside
Apr 2017	Colombo	Sri Lanka	32	Fire

https://geoenvironmental-disasters.springeropen.com/articles/10.1186/s40677-014-0010-5

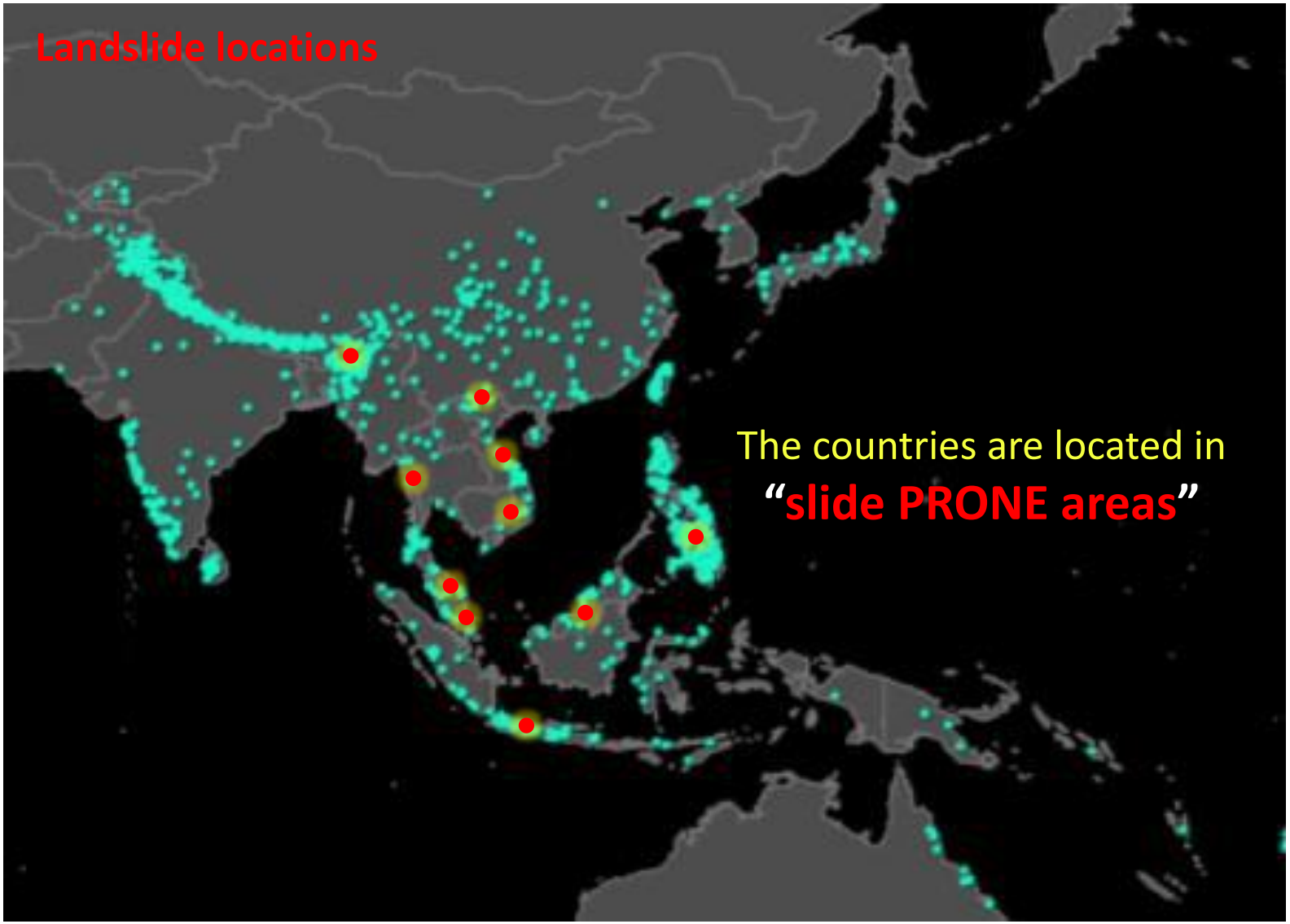
WASTE SLIDE (cont.)

Landslide locations



https://www.nasa.gov/feature/goddard/2016/using-nasa-data-to-detect-potential-landslides

WASTE SLIDE (cont.)



https://www.nasa.gov/feature/goddard/2016/using-nasa-data-to-detect-potential-landslides

To prevent the impacts caused by waste slide, **‘an effective planning and monitoring management system and a proper waste management system are a challenge**’, mainly in underdeveloped and developing countries.

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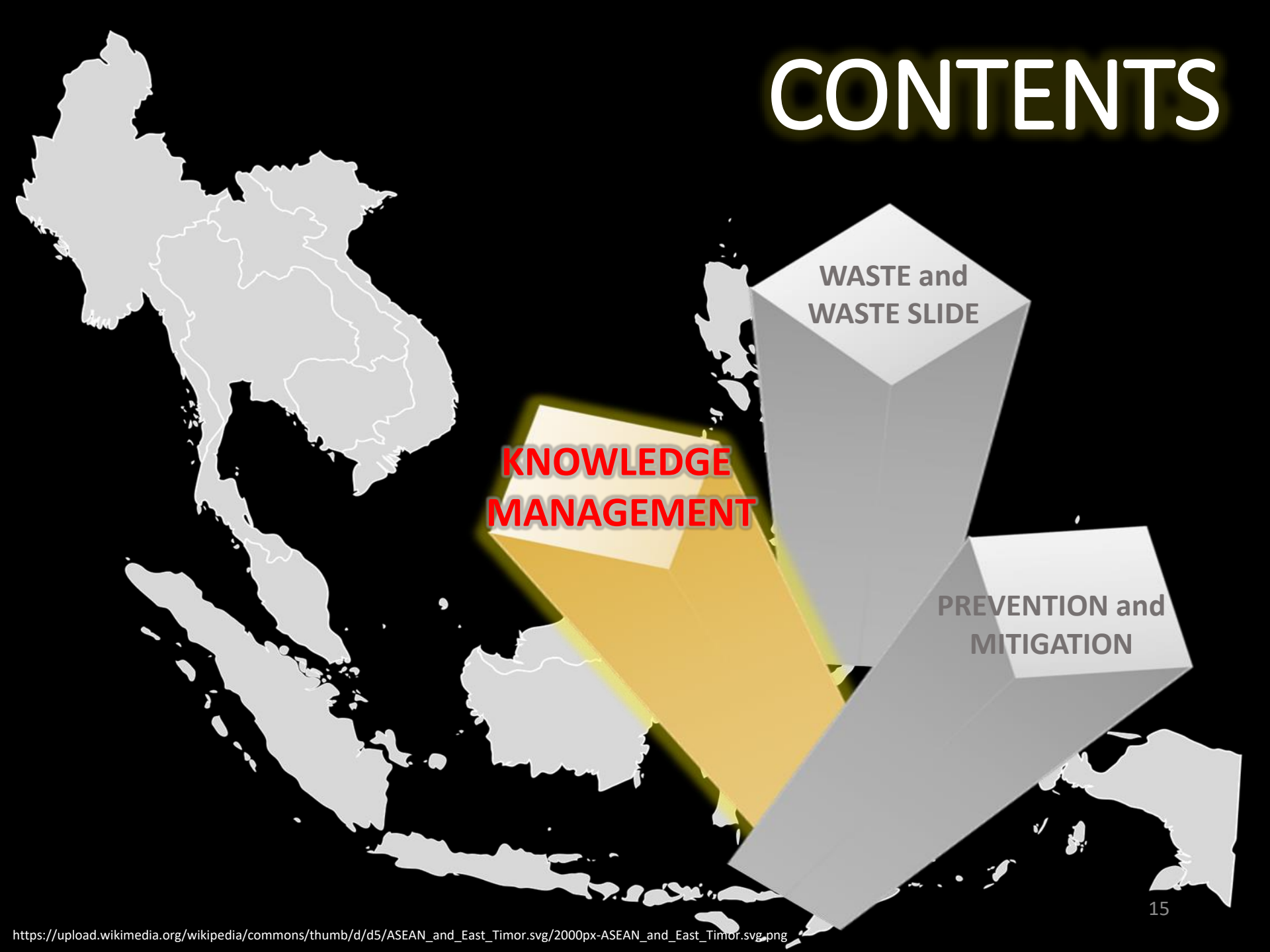


https://upload.wikimedia.org/wikipedia/commons/thumb/d/d5/ASEAN_and_East_Timor.svg/2000px-ASEAN_and_East_Timor.svg.png

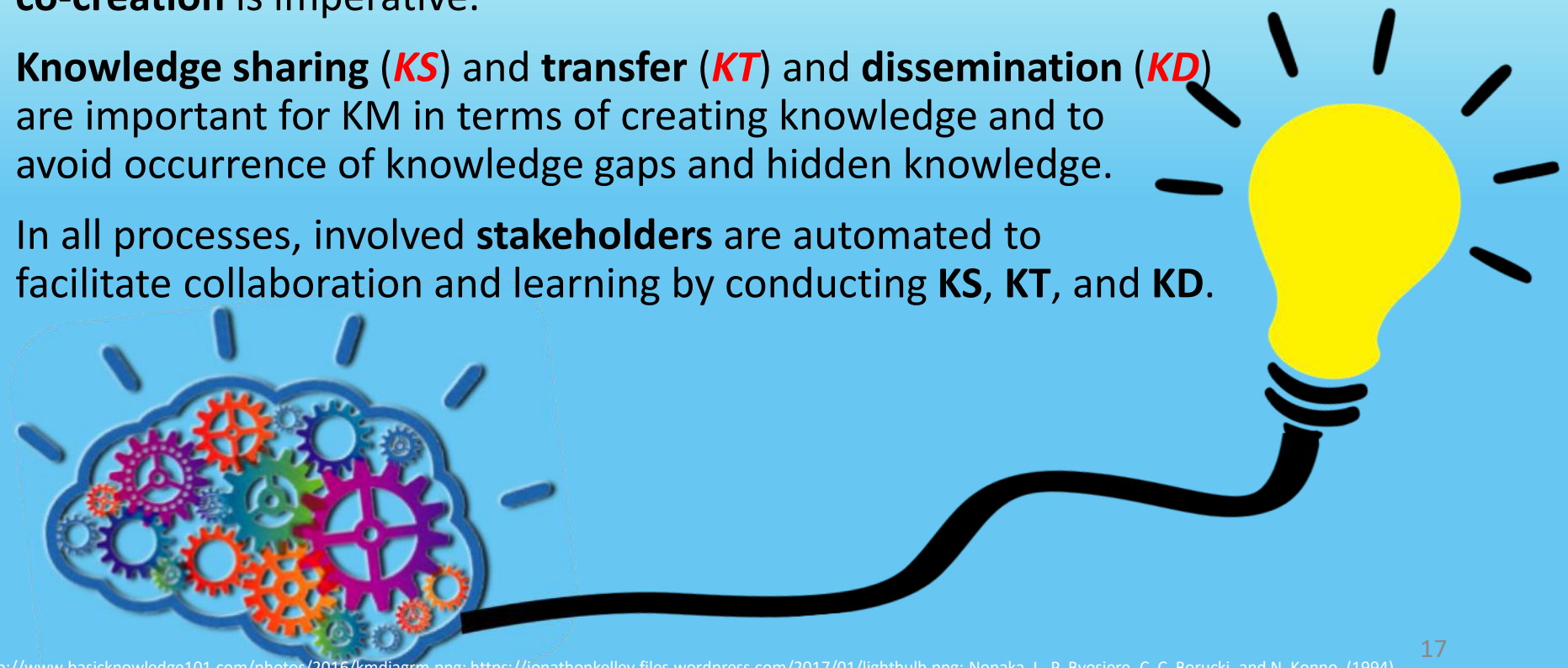
Knowledge Management (cont.)

- **Knowledge** is the most vital and valuable capital for all types of firms or institutions.
- In any management systems, it is essential to make the right knowledge available to the right people at the right time, known as **knowledge management** (**KM**).
- **KM** has increasingly been recognized **across industries** and used as a new concept or a new arising management term.

http://www.mindonsolutions.com/static/upload/mindon-what/tudasmenagm3.jpg; Deng, H. (2010). A conceptual framework for effective knowledge management using information and communication technologies. International Journal of Knowledge and Systems Science, 1(2), 49–61.; Nonaka, I. and Takeuchi, H. (1995). The knowledge-creating company. New York: Oxford University Press.

Knowledge Management (cont.)

- Each process requires different knowledge to effectively manage landfill and prevent landslide risk.
- **Tacit** *(intangible)* knowledge and **explicit** *(tangible)* knowledge are two types of knowledge in knowledge creation.
- To be practical and adaptable to each area, **knowledge co-creation** is imperative.
- **Knowledge sharing** (***KS***) and **transfer** (***KT***) and **dissemination** (***KD***) are important for KM in terms of creating knowledge and to avoid occurrence of knowledge gaps and hidden knowledge.
- In all processes, involved **stakeholders** are automated to facilitate collaboration and learning by conducting **KS**, **KT**, and **KD**.



http://www.basicknowledge101.com/photos/2016/kmdiagrm.png; https://jonathonkelley.files.wordpress.com/2017/01/lightbulb.png; Nonaka, I., P. Byosiere, C. C. Borucki, and N. Konno. (1994). Organizational knowledge creation theory: A first comprehensive test. International Business Review 3(4), 337–351.

Knowledge Management (cont.)

Identified stakeholders from all related sectors
(for both landfill site and landslide perspectives)

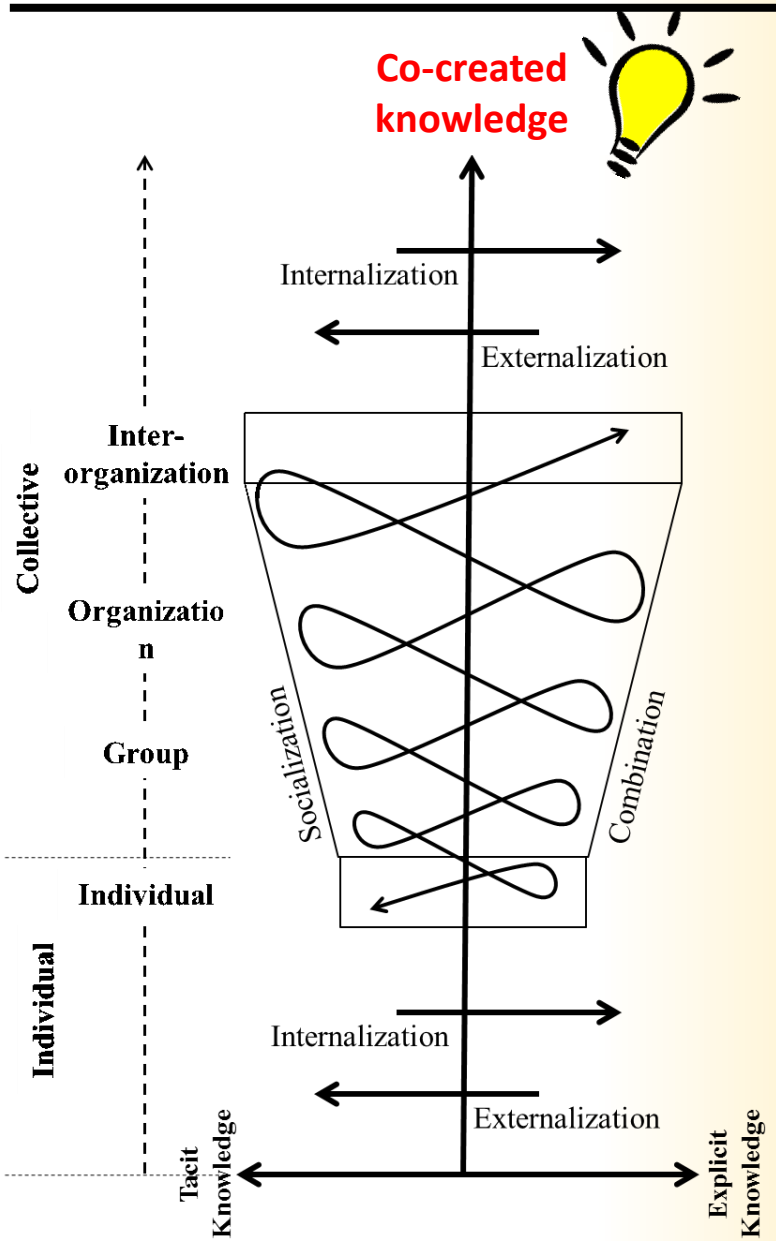
- Residents
- Schools
- Heads of villages
- Engineer and experts
- Local governments and officials

Needed factors
(for both landfill site and landslide perspectives)

- Data and information of past, present, and future situation
- Financial supports
- Technical supports
- Human resources
- Effective regulations

http://4.bp.blogspot.com/-YabV-V5FtvE/VfzETrN3TwI/AAAAAAAAFig/QPMXYQINVFs/s1600/brain%252Blamp.jpg

Knowledge Management (cont.)



Knowledge can be created in both individual and collective levels

Knowledge can be divided into two types, including ***tacit*** *(<u>intangible</u>: ideas, thoughts)* and ***explicit*** *(<u>tangible</u>: reports, books)*.

With the **flow of knowledge**, knowledge is shared (***KS***), transferred (***KT***), or disseminated (***KD***) within or across levels through the process of **practice**, **communication**, and **collaboration**.

With all expertise and experience of involved stakeholders, there is co-created knowledge that suits to **specifically prevent landslide risks**, **manage landfill site**, **or cope with any unexpected circumstances**.

Figure 1: Spiral of organizational knowledge creation

Nonaka, I., P. Byosiere, C. C. Borucki, and N. Konno. (1994). Organizational knowledge creation theory: A first comprehensive test. International Business Review 3(4), 337–351.

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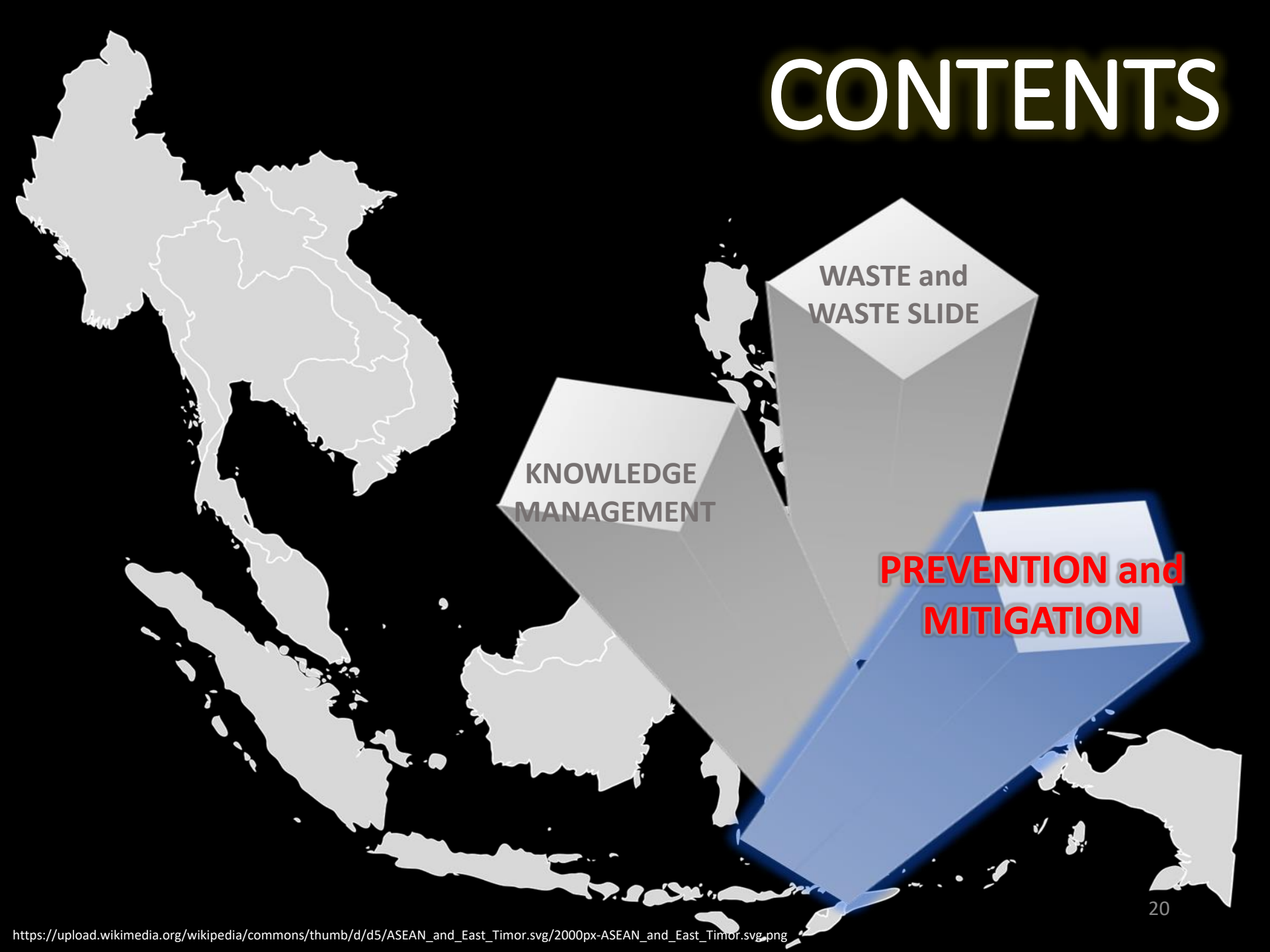

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Prevention and Mitigation

It is imperative to enhance the level of **capacity building** and **awareness raising** of slide disasters.

To have effective implementation, a number of supporting factors are needed:

- **Availability of data** relating to landslide hazard, vulnerability, risk mapping, waste management situation, and a monitoring system.
- **Participation and cooperation** among residents, indigenous, communities, schools, local governments, and other sectors
- **Multi-disciplinary scientific and engineering approaches** are required on taking action.
- **Institutionalization of the local government** to concentrate on risks within the city and its surroundings at the local to national levels.

http://d2sh4fq2xsdeg9.cloudfront.net/contentAsset/image/d263b75e-ed65-496e-a586-68dadd802110/image/bylnode/1/filter/Resize,Jpeg/jpeg_q/69/resize_w/604

Involved Stakeholders

All stakeholders should be involved in setting management framework for recognition and adaptation measures, and together put efforts in achieving common goals.

Residents: to give observable evidence of land movements and historical events

Heads of villages: to be responsible for the record of rainfall intensity

Schools: to be focal points for waste slide risk reduction

Engineers and experts: to provide scientific and technical knowledge for waste slide investigation and implementation on risk reduction, operation, and management

Local governments and officials: to provide inputs (technical, financial supports); to make decisions and policies to institutionalize the reduction of waste slide impacts (early warning system, slope monitoring, education campaigns)

Mitigation and preparedness activities

- **Checking** of geologic profiles, topographic features, soil classification, and pre-slide profile
- **Controlling** of loading and volume of waste, height, vibration, excavation, land use activities
- **Monitoring** of methane and explosive substances, stability of waste, leachate level and treatment, liner system, moisture contents, precipitation, seismic events, surface infiltration and erosion, groundwater condition, retaining wall condition, piping and drainage system
- **Information** of waste composition and characteristics
- **Prevention** of fire, vector, scattering waste, slope failures
- **Protection** of leachate penetration into the groundwater and flowing into the river

http://clipart-library.com/clipart/144092.htm

Mitigation and preparedness activities

http://clipart-library.com/clipart/144092.htm; http://terwel.net/wp-content/uploads/2016/01/Home-Stakeholder-Communications-and-Information-Management-477-x-3041.png; http://clipartall.com/subimg/clipart-light-bulb-lit-light-bulbs-clipart-2273_2400.png

Conclusion

Landslide disasters happen frequently in Asia, so does the possibility of **waste slides** that is mainly caused by excess waste, poor management of landfill, and heavy rainfall.

Applying the **knowledge management** to lessen knowledge gaps and increase engagement of stakeholders is to enhance capacity of communities.

With an active multilateral cooperation**, a good governance system** is profound for fostering stakeholders to co-create knowledge.

School based monitoring system, considering students as catalysts of change, helps reduce the exposure and vulnerabilities.

Through the **knowledge creation process**, disseminating co-created knowledge encourages further awareness raising among stakeholders in broader areas.

Knowledge based risk adaptation mechanism can be replicated by other communities and be able to adopt to other risks to promote **sustainability**.

http://clipart-library.com/clipart/144092.htm

Adaptation of Knowledge Management on Preventive Catastrophic Waste Slide

THANK YOU

http://lifestyle.campus-star.com/app/uploads/2015/12/%E0%B8%9B%E0%B8%A3%E0%B8%B0%E0%B8%8A%E0%B8%B2%E0%B8%84%E0%B8%A1%E0%B8%AD%E0%B8%B2%E0%B9%80%E0%B8%8B%E0%B8%B5%E0%B8%A2%E0%B8%99-2.jpg