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COLLEGE OF COMPUTING AND INFORMATICS  
PUTRAJAYA CAMPUS

FINAL PROJECT

SEMESTER 1 2024/2025

PROGRAMME : Bachelor of Computer Science (Software Engineering)  
(Hons.)  
SUBJECT CODE : CSEB5133  
SUBJECT : Data Visualization Programming  
DATE : December 2024 (Week 14)  
DURATION : 2 weeks

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INSTRUCTIONS TO CANDIDATES:

1. The total assessment percentage for this final project assessment is 40.
2. This is an individual assessment.
3. Students need to complete the project in time and demonstrate the project outcome according to the project tasks and project assessment.

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THIS QUESTION PAPER CONSISTS OF ELEVEN (11) PRINTED PAGES  
INCLUDING THIS COVER PAGE

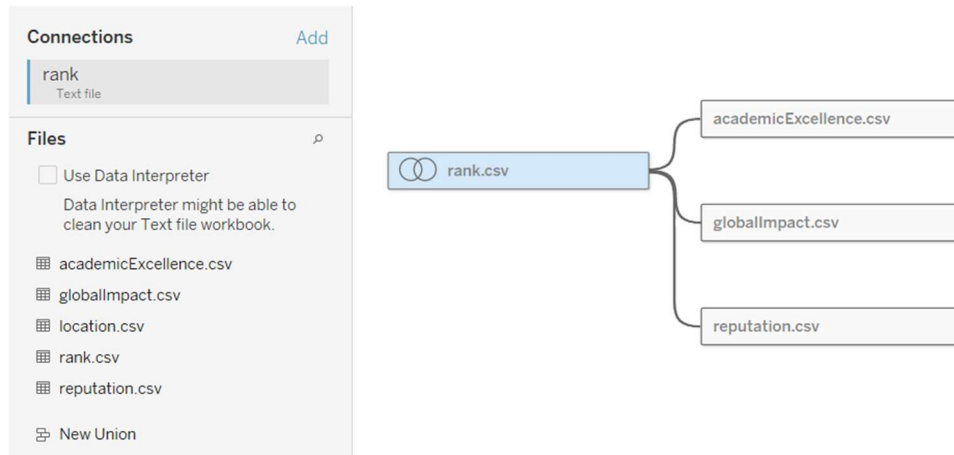
## PROJECT TASKS

### A. The project theme for me is:

- (i) Education and Learning

B. Develop a visualization dashboard using Tableau software according to the theme assigned to you. The development should contain the following components:

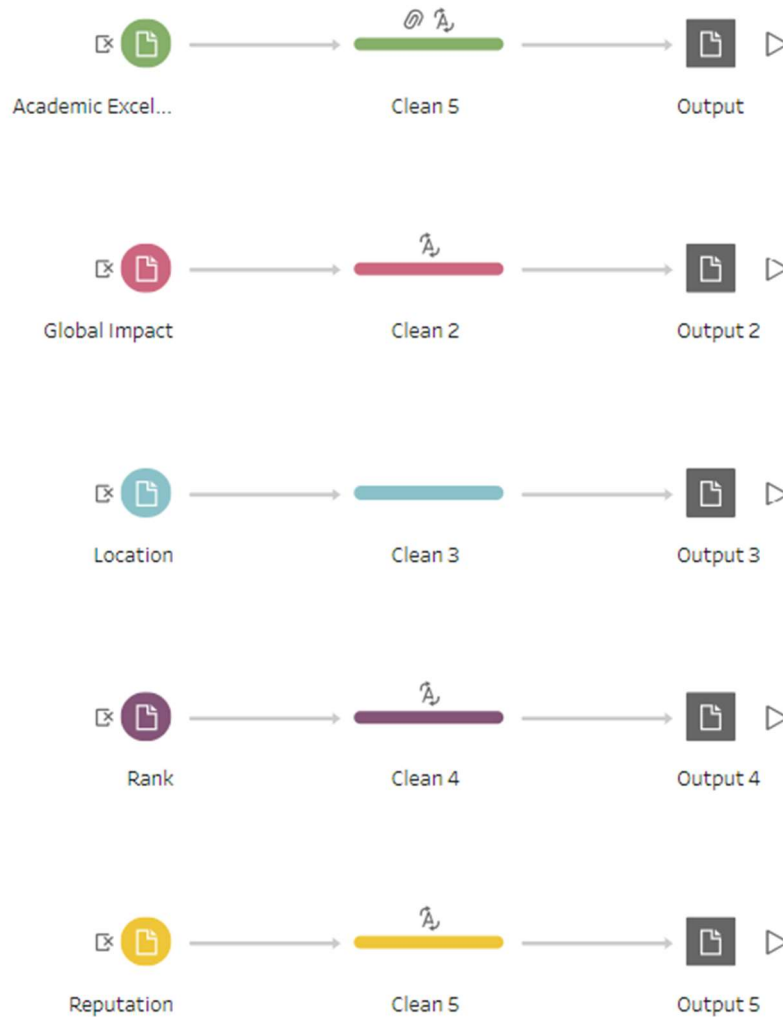
- (i) Data connection
- Connect to and import data from various sources such as Excel, CSV, pdf, databases or web data connectors.
  - Blend or join multiple data sources for comprehensive analysis.



The diagram illustrates a data integration process where multiple datasets are joined. The primary dataset, rank.csv is inner join with location.csv. Then combined with three additional datasets: academicExcellence.csv, globalImpact.csv, and reputation.csv.

## (ii) Data Preparation:

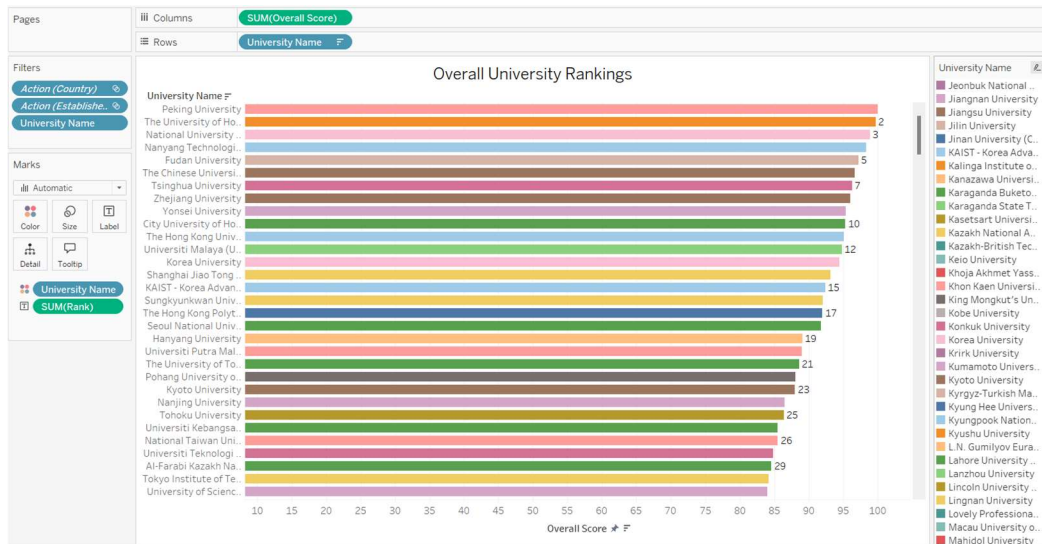
- Using Tableau Prep, perform data preprocessing phase.
- Handle null values, format data types, and aggregate data as required.



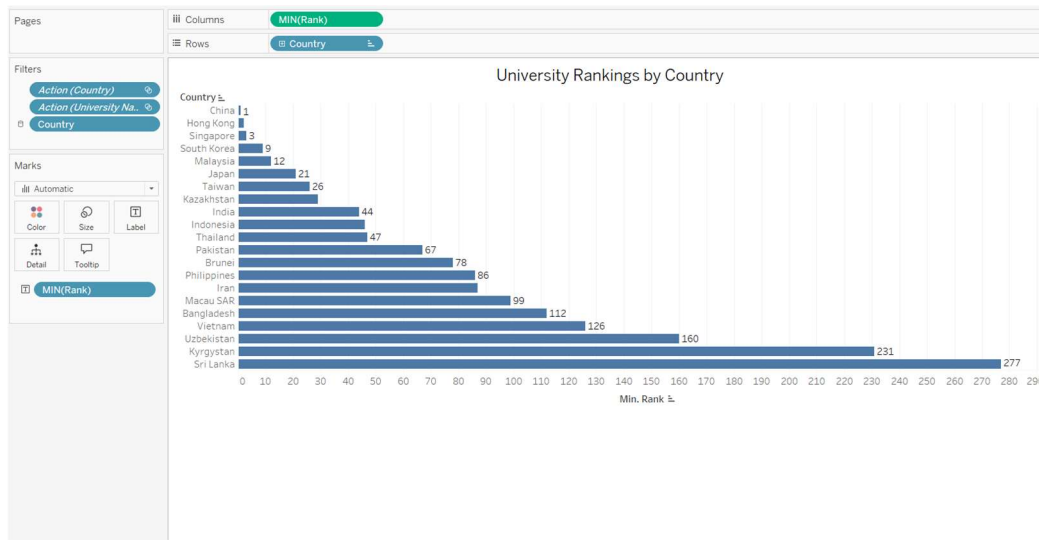
The image represents a data cleaning workflow with multiple inputs and outputs. Each input corresponds to specific datasets like "Academic Excellence," "Global Impact," "Location," "Rank," and "Reputation." These datasets have undergone individual cleaning processes to ensure data accuracy and consistency. The datasets were cleaned by removing null values and changing data type from text to decimal or whole number for Academic Excellence, Global Impact, Rank and reputation. After cleaning, the processed data is exported as outputs, ready for analysis or visualization. This modular approach simplifies handling diverse data sources by applying tailored cleaning steps for each dataset.

## (iii) Visualizations:

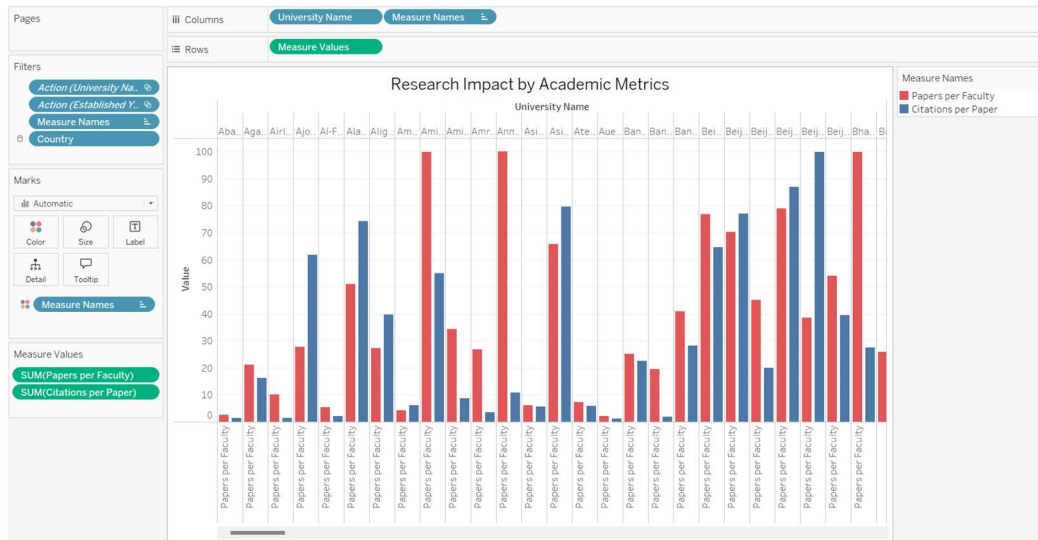
- Utilize a variety of charts and graphs to present data insights effectively.
- Incorporate dual-axis, combined axis, and trend lines for enhanced visual representation.



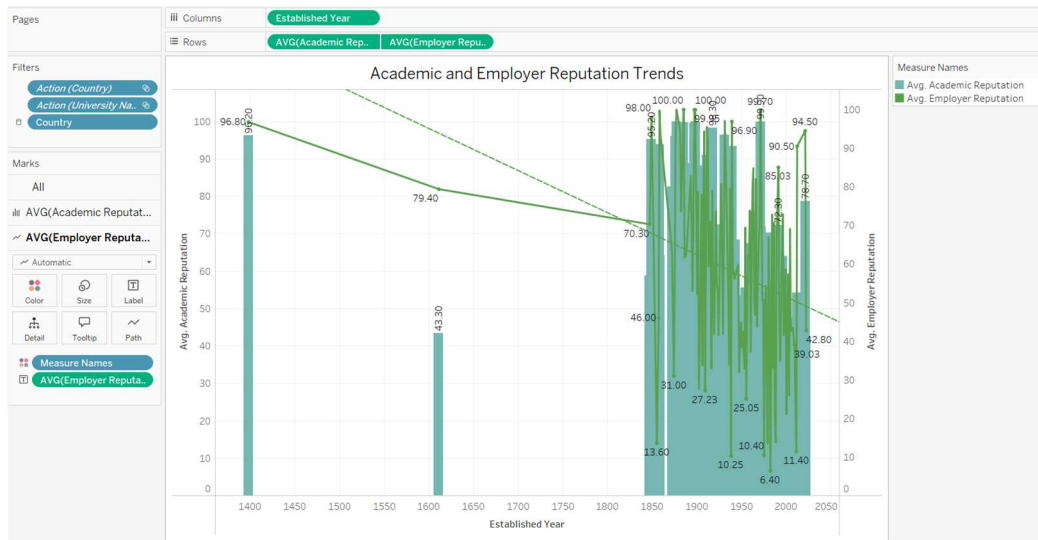
The rankings highlight the performance of universities in Asia based on overall scores, showcasing institutions across different countries. Top-ranked universities include Peking University (100 overall score, Rank 1), The University of Hong Kong (overall score 99.7, Rank 2), and the National University of Singapore (overall score 98.9, Rank 3). These universities demonstrate academic excellence and global recognition. Other notable institutions like Al-Farabi Kazakh National University (overall score 84.6, Rank 29) and Taylor's University (overall score 81.3, Rank 36) emphasize regional academic strength. Many universities, such as Asia Pacific University in Malaysia (overall score 41, Rank 192) and Bandung Institute of Technology (overall score 69.1, Rank 59), represent growing global competitiveness. The rankings showcase the diversity of educational opportunities and research excellence across various countries.



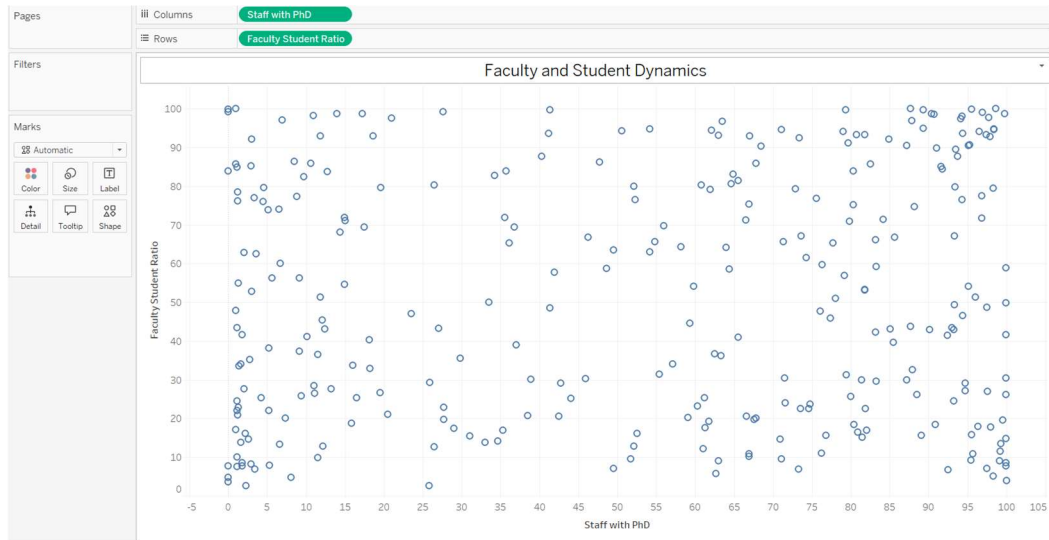
The table presents a ranking of countries in Asia based on their minimum rank in a specific global or regional index, which could reflect areas such as education, technological advancements, or economic performance. China holds the top position, underscoring its dominance in the evaluated criteria, followed by Hong Kong and Singapore, which are also highly competitive. South Korea and Malaysia are notable regional players, ranked 9th and 12th respectively, showcasing their strengths. In the mid-tier, countries like India (44), Indonesia (46), and Thailand (47) demonstrate significant potential, while others like Bangladesh (112), Vietnam (126), and Uzbekistan (160) indicate ongoing development challenges. Lower-ranked countries, such as Kyrgyzstan (231) and Sri Lanka (277), reflect areas requiring substantial improvement. Small and specialized economies, including Brunei (78) and Macau SAR (99), rank relatively well, considering their size and resources. Overall, the rankings highlight East Asia's dominance, led by countries like China, South Korea, and Japan, while Southeast Asia and South Asia display mixed results, with some nations excelling and others far behind.



The dataset includes information about universities, focusing on two important metrics: "Citations per Paper" and "Papers per Faculty." These metrics are used to evaluate the research productivity and influence of institutions. Citations per paper indicate how often the research papers published by the university are cited by others. A higher number suggests that the university's research is highly regarded and has a significant impact. On the other hand, papers per faculty measure the average number of research papers produced by each faculty member. A higher number means that faculty members are publishing more research. Both metrics help assess the academic strength of a university and can give an idea of its overall research output and global standing. Overall, most of the universities that have higher number of citations per paper also get higher number of papers per faculty.



The data shows a general decline in academic and employer reputation scores for institutions founded in more recent years. Older institutions, particularly those established in the 1400s and early 1900s, consistently score higher in both metrics, with employer reputation often exceeding 90. In contrast, institutions established after 2000 show a noticeable downward trend, with academic reputation rarely surpassing 35 and employer reputation remaining moderate. This decline suggests that newer universities struggle to establish strong reputations in both academic and industrial domains. Despite occasional exceptions, the overall trend highlights the challenges faced by newer institutions in building recognition comparable to their older counterparts.

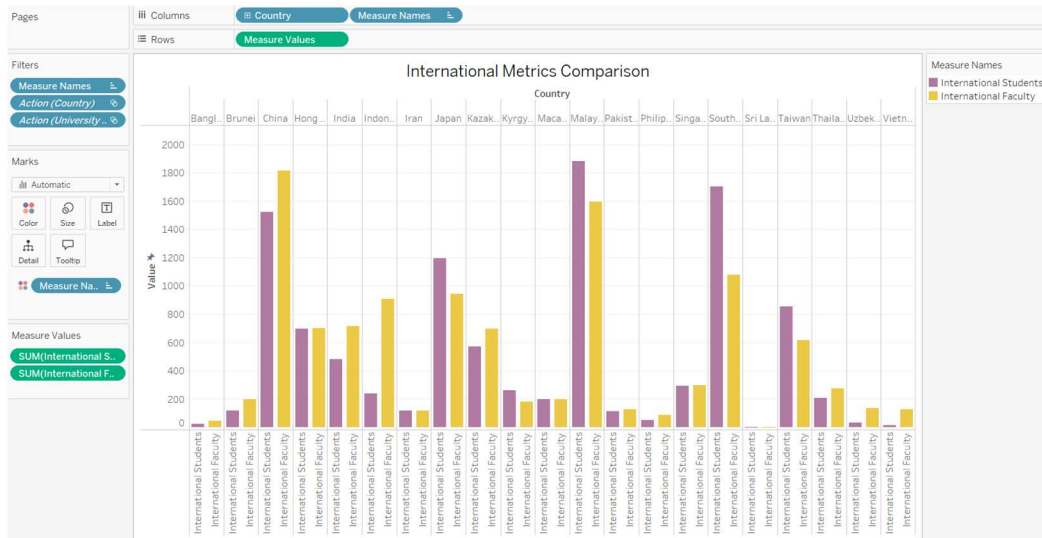


The graph titled "Faculty and Student Dynamics" illustrates the relationship between the percentage of faculty members with PhDs and the faculty-student ratio at various universities. The X-axis represents the percentage of staff with PhDs, while the Y-axis shows the faculty-student ratio, where a lower ratio indicates that students receive more individual attention from faculty members.

The data points on the graph are spread across the chart, representing different universities with varying levels of PhD-qualified staff and different faculty-student ratios. A trend line is plotted to show the relationship between the two variables. The line suggests a weak positive correlation, meaning that as the percentage of PhD-qualified staff increases, the faculty-student ratio tends to rise slightly, though the correlation is not strong.

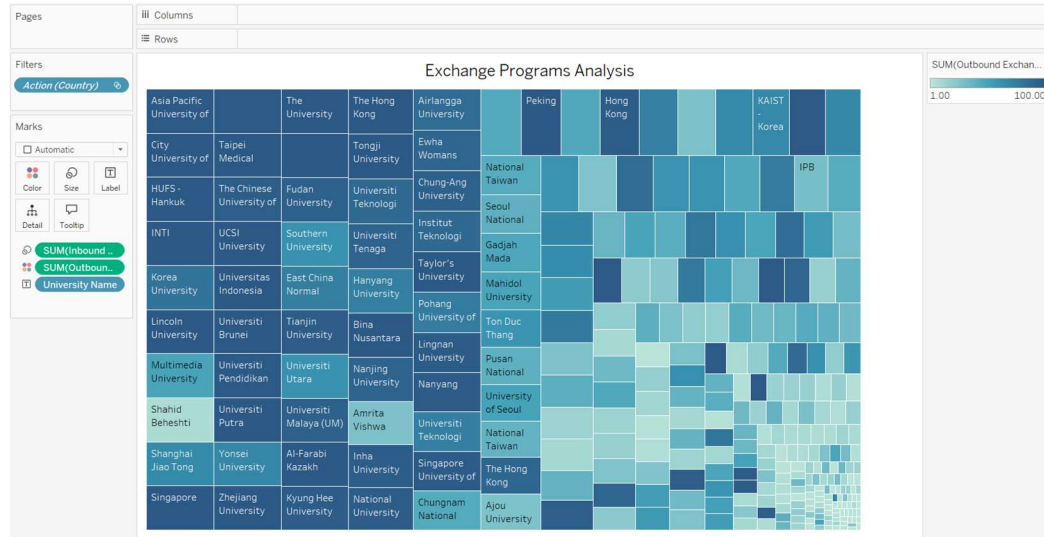
The graph also reveals that a higher percentage of PhD staff does not necessarily lead to a lower faculty-student ratio. Some universities with fewer PhD staff still manage to have favorable faculty-student ratios, indicating that other factors, such as funding, resources, or institutional policies, may also play a significant role in shaping the faculty-student dynamic.





The data compares the average number of international students and faculty across several Asian countries, showing significant variations. Countries like Hong Kong, Macau SAR, and Singapore have near 100% international representation among both students and faculty, indicating highly internationalized educational systems. These nations attract a large number of foreign scholars and students, fostering a diverse and globally connected academic environment. In contrast, countries like Malaysia and South Korea show moderate international participation, with around 50-75% international students and faculty, suggesting they are growing in global academic stature.

On the other hand, countries such as Sri Lanka, Pakistan, and Vietnam have much lower percentages of international students and faculty. Sri Lanka, for example, has very low numbers in both categories, indicating a more regionally focused academic system. These countries likely face challenges in attracting international talent due to limited global outreach or resources. Overall, the data highlights the varying degrees of internationalization across Asian countries, with some offering more global opportunities than others.



The highest exchange rates represent universities with a strong international presence, such as City University of Hong Kong, National University of Singapore, and Universiti Kebangsaan Malaysia. These institutions actively participate in global exchange programs, with both inbound and outbound rates reaching 100%.

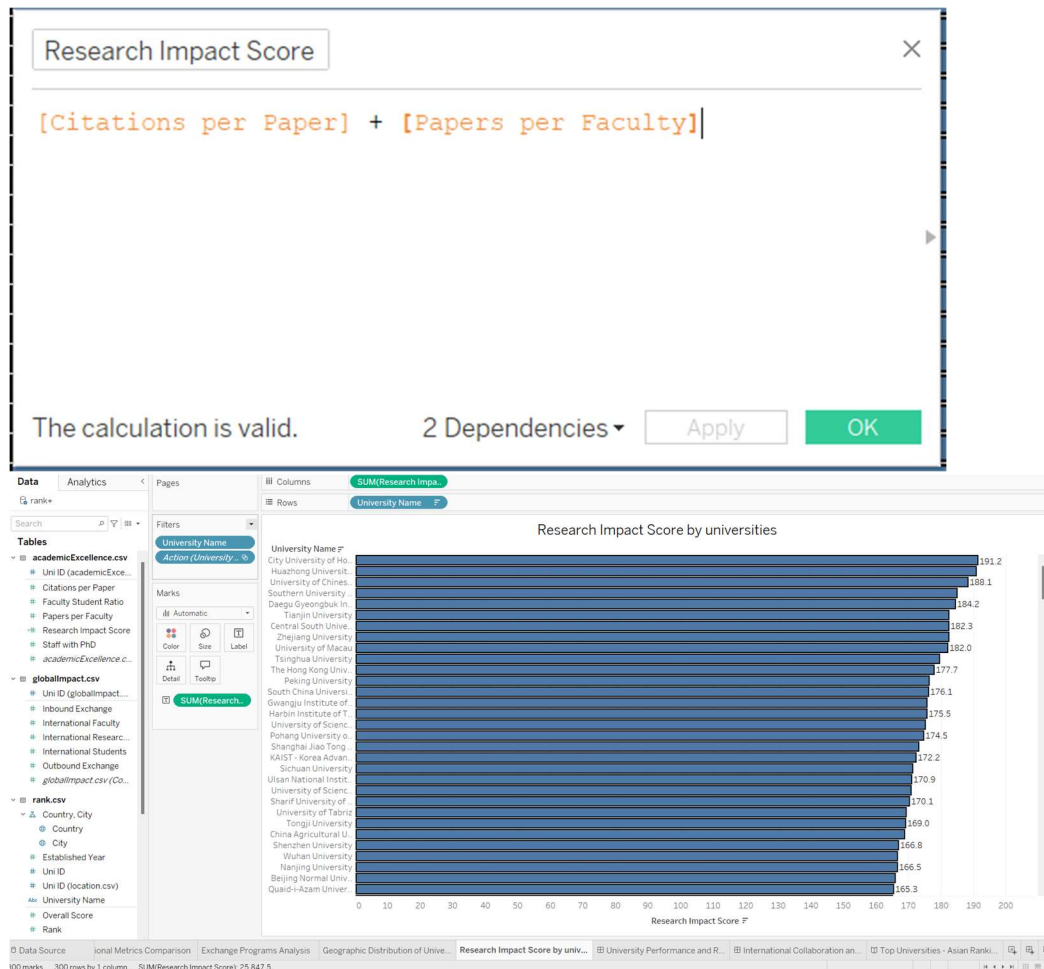
Moderate exchange figures indicate universities with a balanced international exchange program. Examples include Asia Pacific University of Technology and Innovation, where inbound and outbound exchange numbers are close to each other, reflecting consistent international engagement. Similarly, institutions like KAIST and Hanyang University maintain strong but not overwhelming exchange figures.

Universities with the shortest exchange numbers have limited international engagement. Schools like Aligarh Muslim University and Siksha 'O' Anusandhan University show very low inbound or outbound exchange rates, suggesting a less active participation in global exchange networks.

Other universities fall in a middle category, offering a variety of exchange opportunities. Universities such as Peking University and Tsinghua University demonstrate solid exchange activity, placing them between the moderate and high categories, reflecting their balanced yet impactful global outreach.

## (iv) Calculations and Expressions:

- Employ calculated fields, table calculations, and level of detail (LOD) expressions to perform complex calculations and derive insights.
- Create custom calculations to analyse trends, percentages, rankings, or other metrics relevant to the dataset.

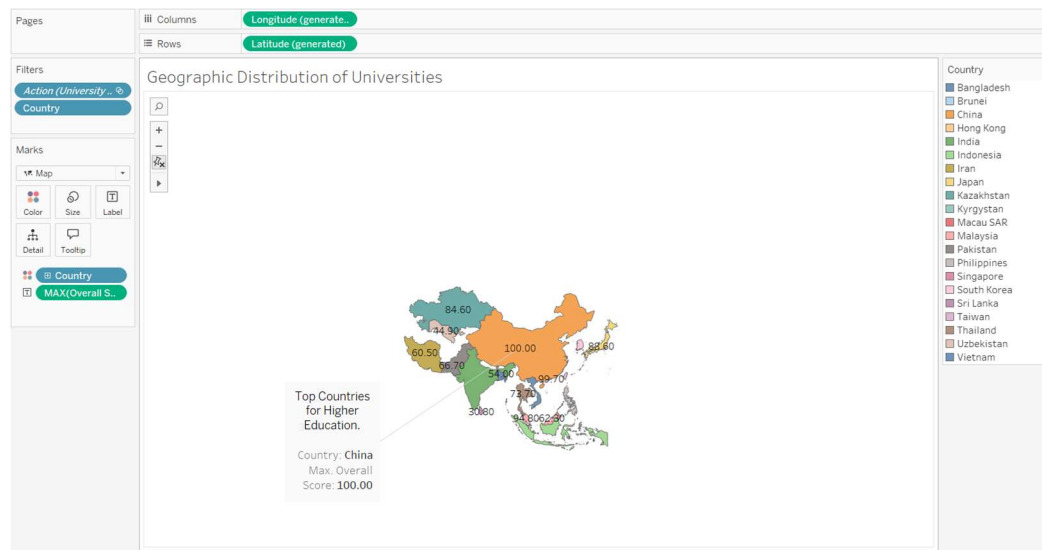


The Research Impact Score is calculated by combining two key metrics: Citations per Paper and Papers per Faculty. Citations per Paper measures how often a university's research publications are cited by other scholars, reflecting the impact and relevance of the research within the academic community. Papers per Faculty indicates the average number of research papers published by each faculty member, showcasing the research productivity of the university's academic staff.

By using the formula  $\text{Research Impact Score} = \text{Citations per Paper} + \text{Papers per Faculty}$ , this score provides an overall indication of both the quality (via citations) and quantity (via papers per faculty) of research output, helping assess a university's research strength and influence in its field.

(v) Mapping:

- Incorporate geographical analysis by plotting data on maps using built-in geographic roles, custom geocoding, or background images.
- Use Map Layers and Map Options to enhance map visuals and provide context to data points.



The data shows the maximum overall scores of various countries and regions in Asia, with their respective latitude and longitude coordinates. Countries like China, Hong Kong, and Singapore have the highest scores, with China at 100, Hong Kong at 99.7, and Singapore at 98.9, highlighting their top positions in the comparison. South Korea and Malaysia also perform exceptionally well with scores of 95.4 and 94.8, respectively. On the other hand, countries like Sri Lanka, Kyrgyzstan, and Uzbekistan have comparatively lower scores, with Sri Lanka at 30.8 and Kyrgyzstan at 35.3.

This gradient shows the variance in scores across the region, with countries like Japan, Taiwan, and Kazakhstan positioned in the mid-to-high range, indicating their strong regional performances. Meanwhile, nations such as Bangladesh and the Philippines still rank well, but their scores remain below 65, which suggests areas for improvement relative to other countries in the list.

## (vi) Dashboards:

- Build a well-organized dashboard layout with multiple visualizations to convey a cohesive story.
- Implement device-specific layouts to ensure responsiveness across various devices (desktop, tablet, mobile).
- Include dashboard actions like filters, highlighters, and URL actions for interactivity.

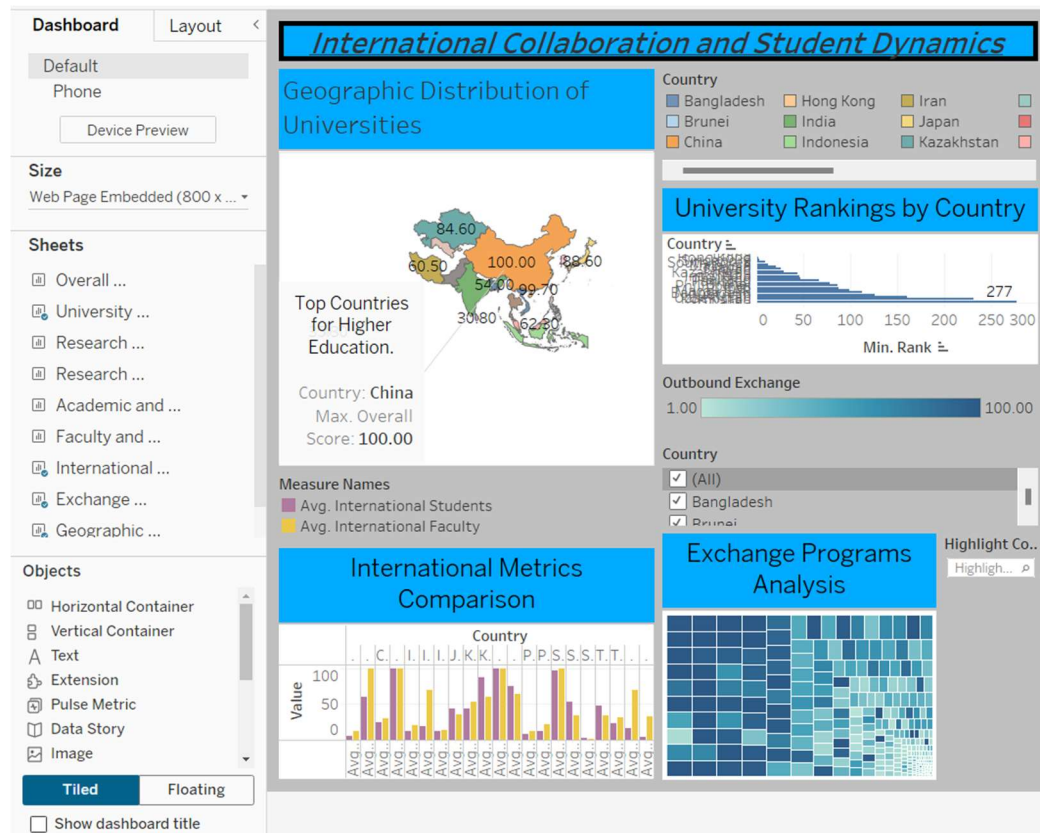
## (vii) Interactivity:

- Add interactive elements such as filters, parameters, and quick filters to enable users to explore and analyse data dynamically.
- Use dashboard actions (highlight, filter, URL actions) to link different sheets or dashboards for a seamless user experience.



The first dashboard, focused on university performance and reputation, provides a comprehensive overview that includes overall university rankings, research impact based on academic metrics, and a detailed breakdown of the research impact score for individual universities. It also visualizes trends in academic and

employer reputation over time. The dashboard is interactive, featuring filters and highlighters that allow users to focus on specific universities, making it easy to analyze performance, research impact, and reputation dynamics. This dynamic approach allows users to gain insights into how universities compare in terms of research, reputation, and overall performance across different dimensions.

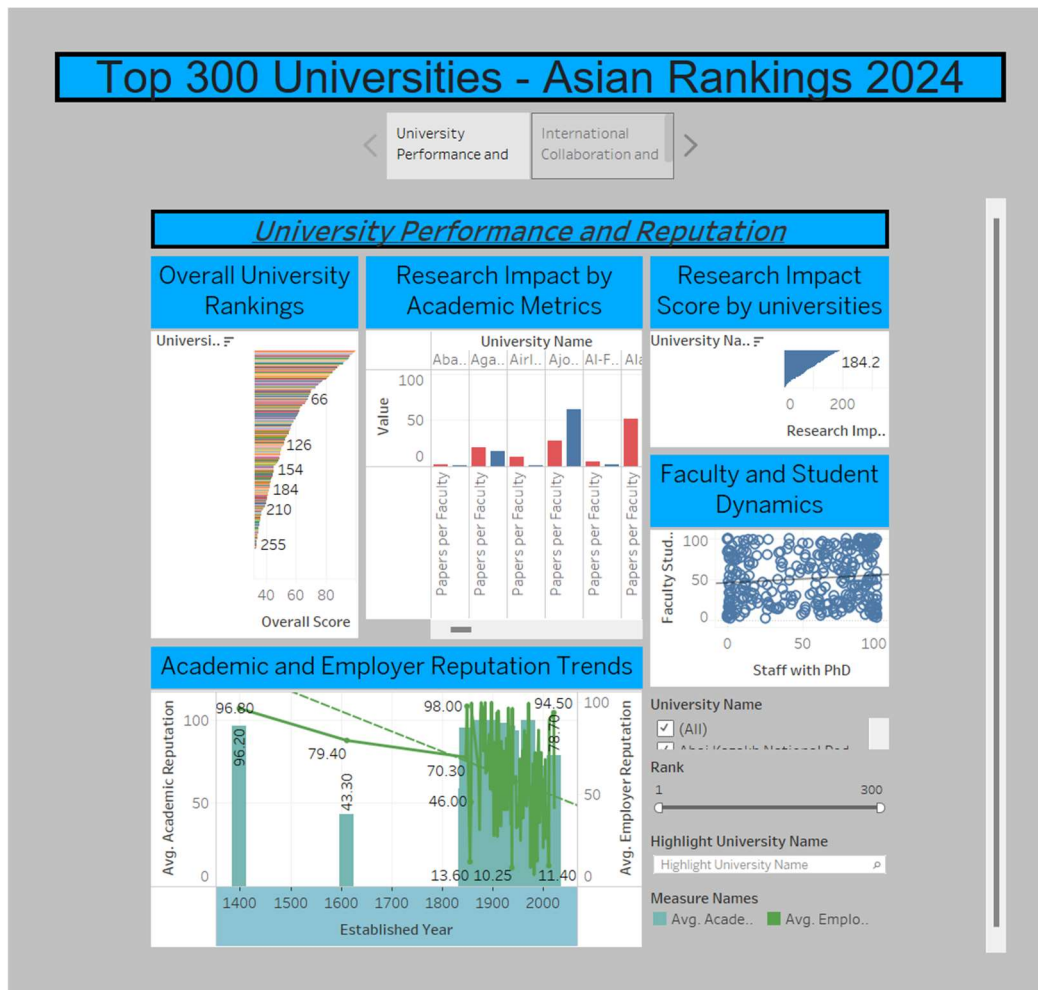


The second dashboard, centered on international collaboration and student dynamics, offers a detailed view of the geographical distribution of universities, highlighting their global presence. It includes university rankings by country, providing a comparative analysis of universities' standing in different nations. The dashboard also analyzes exchange programs, showcasing trends and opportunities for international student mobility. Additionally, it offers a comparison of international metrics, such as global rankings and performance indicators. With filters and highlighters for selecting specific universities, users can easily navigate and focus on relevant data, facilitating a deeper understanding of international collaborations, student exchanges, and global rankings.



## (viii) Annotations and Storytelling:

- Add annotations, reference lines, and tooltips to explain specific data points or trends within visualizations.
- Utilize story points or storyboards to present a sequence of visualizations that tell a compelling data-driven narrative.





In the story, the first tab is dedicated to Dashboard 1, accessible through URL university performance and reputation, while the second tab contains Dashboard 2, accessible via URL international collaboration and student dynamics. Notably, Dashboard 1 focuses on university performance and reputation, providing key insights into overall university rankings, research impact metrics, and academic and employer reputation trends. Dashboard 2, on the other hand, is centered on international collaboration and student dynamics, showcasing the geographical distribution of universities, university rankings by country, exchange program analysis, and a comparison of international metrics. A notable finding from the geographic distribution of universities is that China stands out as the top country for higher education, with a maximum overall score of 100. Both dashboards include filters and highlighters, allowing users to easily focus on specific universities, countries, or metrics for a more tailored and dynamic experience.



Sharing and Collaboration:

- Share the dashboard via Tableau Server, Tableau Online, or Tableau Public to allow for easy access and collaboration.

<https://public.tableau.com/app/profile/muhamad.asyraf.fahmi.mohd.saiful.hazmi/viz/SW01082352TOP300UNIASIA/UniversityPerformanceandReputation?publish=yes>

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