Infrastructure Readiness for Blended Learning Education Business in Indonesia After Covid-19

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ABSTRACT

This research is conducted to find the most suitable digital platform for blended learning business in Indonesia by analyzing the proportion population of desktop and mobile device owners for 9 years within 2015 to 2023. The data used for the analysis is quantitative and sourced from the dataset of Indonesian Statistic (BPS). It aims to give a better decision for education business players in choosing digital platform by province in Indonesia. The results of the study prove a significant mobile platform growth which cannot be caught up by desktop platform for most of the provinces. But surprisingly besides Java and Bali, these provinces have the highest proportion users of both desktop and mobile devices among other provinces i.e. The Riau Islands, North Kalimantan and East Kalimantan.

Keyword: *Blended Learning*; Mobile Device; Desktop Device; Education Business; Time Series Analysis.

ABSTRAK

Penelitian ini dilakukan untuk menemukan platform digital bisnis pembelajaran *hybrid* yang paling sesuai di Indonesia dengan menganalisis proporsi kepemilikan perangkat desktop dan perangkat mobile oleh penduduk selama 9 tahun, yakni dari 2015 hingga 2023. Data yang digunakan bersifat kuantitatif dan bersumber dari dataset Badan Pusat Statistik (BPS). Tujuan penelitian ini adalah memberikan masukan bagi pelaku bisnis pendidikan dalam menentukan pilihan platform digital yang tepat berdasarkan kondisi masing-masing provinsi di Indonesia.

Hasil penelitian menunjukkan adanya pertumbuhan signifikan pada penggunaan platform mobile yang tidak dapat terkejar oleh platform desktop di sebagian besar provinsi. Namun, secara mengejutkan, selain Jawa dan Bali, terdapat beberapa provinsi yang memiliki proporsi pengguna desktop dan perangkat mobile tertinggi dibandingkan provinsi lainnya, yaitu Kepulauan Riau, Kalimantan Utara, dan Kalimantan Timur.

Kata kunci: Blended Learning; Perangkat Selular; Perangkat Komputer Desktop; Bisnis Pendidikan; Analisis Deret Waktu.

INTRODUCTION

Indonesia already has distance learning and blended learning long prior covid-19 named Open University, established in 1984. In that era there were not so many countries implemented such a formal education. Even developed countries such as the Netherland, Belgium, etc. It is due to their supportive geographic condition and good transportation connectivity. While an archipelago like Indonesia - as the biggest archipelago country in the word - must implement distance learning to fullfill its citizen's higher education need who lived at remote area. Moreover no private companies were interested in taking a part in this kind of education.

This kind of education got improved when the information and communication can be accessed through internetd and realtime in the 90's as long as there were strong signal of telecommunication connection. Besides the compatible hardware dan software must meet minimal requirement to access the data. In that era, the exchange of information among internet users were used more for informal

education and fun. There appeared discussion chatroom such as hotmail for international scale, while in Indonesia Kaskus became the most prominent chatroom.

In 2020 with outbreak of covid-19, suddenly all people in the world were pushed to do lockdown. The more people started to use communication via internet, particularly in this topic about higher students must implement full online learning. The students and parents learnt to get used to internet application. The faculty and staff members must provide engaging online learning experience. The government was required to provide strong but economical internet connection in such a short preparation period. All of a sudden all stakeholders in formal higher education were pushed to adapt in all aspects related to their function in the ecosystem. From compulsion to adapt from offline to online learning, makes people got used to it. After the lockdown was revoked, business players in higher education see the opportunity to design it as a blended learning for students who need flexibility. Not only for them with geographic barrier, but also fulltime employees who can't join the class in working hours, disabled students who has mobility issues and many more. Particularly the trend nowadays in certain business sector which requires the students to implement directly at work right after some education session, but he must still learn in parallel so he won't miss the latest competency in his industry such as tourism, entertainment, aviation, logistics, etc.

How the readiness of Indonesia in fullfilling this requirement so that the blended learning will be effective for the students, will be researched in this study. The author will compare the signal strength and coverage of the telecommunication infrastructure. The consumers' ownership for both desktop and mobile gadget will be analyzed as well, then compared to telco infrastructure's finding. From the comparison will be concluded which provinces in Indonesia might be good for higher education with blended learning and which provinces need improvement.

LITERATURE REVIEW

This study presents the importance of the infrastructure in supporting blended learning. Since the more and more higher education implement it in its curriculum. The journal article of Abdul Gafur Marzuki in 2024 concluded that blended learning that combines technology and traditional methods will create a more dynamic and holistic learning experience to the students (Abdul Gafur Marzuki, 2024). In Iqra Journal by Leni Marlena and her team from State University Surabaya also mentioned that one of the main obstacles to online learning is learning infrastructure and the availability of internet facilities (Novi Marlena et al., 2022). In International Journal Of Academic Research In Business and Social Sciences from Kebangsaan Malaysia University stated that digital learning can provide new opportunities in the field of work because of the availability of accuracy at a high speed upon searching for information onto students (Vinothini A/p Muniandy & Intan Farahana Kamsin, 2024). Similar statement is given by (Sayida Khoiratun Nisak et al., 2025) **,** (Efa Elfrieda Abu Bakar et al., 2024) and (Kristen Fox et al., 2021)**.** Other report conducted by some international institutions such as OECD (OECD Team, 2023), ASEAN (ASEAN Team, 2022), World Bank (Julia Clark et al., 2025) , European Union (Julian Fraillon, 2023) and ERIA (Lurong Chen et al., 2023) also mentioned many benefits as well as challenges faced by blended learning education.

Continuing the conference poster "Assessing Indonesia's Infrastructure For Digital Distance Learning" presented by Alvaro Rifat Danendra at Eduvate 2025 Conference - Monash University Indonesia, it portrayed the coverage of BTS in all provinces in Indonesia within 2021 – 2023 as the latest dataset from Statistic Indonesia (Alvaro Rifat Danendra, 2025). Along with the dataset of the percentage of mobile devices owner and desktop owner by province within the same year range, those three variables analyzed the growth, gender, user age and the gap between city and village. In this research. The author wants to do deeper analysis in the long run to analyze the trend of mobile and desktop ownership within 9 years which has never been done before. By using time series analysis, this research emphasize more on the result for practical decision by telco business and all related

business, Particularly business players in blended learning education business as the focus of this research. Mainly in choosing the suitable platform such as operating system.

RESEARCH METHOD

This research applies a time series analysis within a quantitative methodological framework in order to examine the trend and development patterns of the selected variables over time. The dataset utilized in this study is a secondary dataset obtained from Statistics Indonesia (Badan Pusat Statistik/BPS), covering the period from 2015 up to the most recently available year, 2023.

The dataset consists of two main variables, namely the proportion of mobile device ownership and the proportion of desktop device ownership, each measured at the provincial level across Indonesia. Although the dataset formally includes all 38 provinces, there are several administrative adjustments in the data representation. Specifically, the values for South Papua, Central Papua, and Highland Papua are reported under the broader category of Papua Province, while the value for Southwest Papua is incorporated into West Papua Province.

For the purpose of analysis, the units of measurement are expressed as proportions, which indicate the percentage of the population within each province that owns the respective type of device. This approach allows for a more accurate representation of digital access and technological penetration across different regions, thereby providing meaningful insights into the patterns and disparities of device ownership throughout the Indonesian provinces over the given time period.

RESULT AND DISCUSSION

The comparison of two variables i.e. mobile device owner and desktop owner shows there is a significant gap between both dataset trends. Desktop owner shows low proportion in 9 years ranging from nearly 10% up to 39%, while mobile device owner min-max is 32% and 82%. Even the lowest percentage of mobile device owner within 9 years reminds nearly the same as the highest percentage of desktop device owner. DKI Jakarta, DI Yogyakarta, Banten and Bali rank consistently as the highest device ownership for both devices within 9 years with min-max 18% up to 39% for desktop and 60% - 82% for mobile devices. Unlike West Papua which has medium percentage of both devices similar to many other provices, Papua province has the lowest percentage of desktop device owner within 9 years with minimum nearly 10% and maximum nearly 13% for desktop, while mobile devices ranges 32% - 40%. This might be caused by the geographic condition in Papua which results to low BTS availability in that area (Alvaro Rifat Danendra, 2025). Overall growth of mobile devices in 2015 – 2023 is circa % up to 40%. On the other hand desktop shows decrease in some provinces and a little increase some others. The decrease happens in 26 provinces circa -1% up to -21% with North Sulawesi as the highest decrease. While the growth are circa 2% - 18% with NTT as the highest growth.

No	Sumatra	2015	2016	2017	2018	2019	2020	2021	2022	2023	MIN	MAX
1	ACEH	16.81	17.48	18.50	19.55	17.08	17.31	15.62	13.70	15.10	13.70	19.55
2	SUMATERA UTARA	14.22	14.97	14.28	16.61	15.64	15.49	15.74	15.41	15.39	14.22	16.61
3	SUMATERA BARAT	21.90	21.00	20.35	22.62	21.02	20.62	22.43	20.14	19.75	19.75	22.62
4	RIAU	21.33	21.51	21.08	22.78	19.34	20.52	19.74	18.58	18.65	18.58	22.78
5	JAMBI	18.02	17.81	18.07	18.25	17.25	17.25	17.86	16.24	17.75	16.24	18.25
6	SUMATERA SELATAN	14.48	15.10	16.62	15.66	14.57	14.97	14.42	14.42	14.78	14.42	16.62
7	BENGKULU	20.23	19.48	19.21	19.98	19.51	20.26	18.47	17.90	17.83	17.83	20.26
8	LAMPUNG	11.68	11.48	12.24	12.60	11.57	11.71	11.39	10.70	10.63	10.63	12.60
9	KEP. BANGKA BELITUNG	18.26	20.82	20.95	21.95	18.42	19.40	18.91	17.89	19.64	17.89	21.95
10	KEP. RIAU	28.54	30.19	27.95	31.44	30.26	27.09	31.08	27.47	31.46	27.09	31.46

Picture 1. Proportion of Desktop Ownership in Sumatra Area within 2015 - 2023

No.	Sumatra	2015	2016	2017	2018	2019	2020	2021	2022	2023	MIN	MAX
1	ACEH	51.50	52.97	54.20	59.05	57.75	59.60	61.20	62.65	62.87	51.50	62.87
2	SUMATERA UTARA	52.87	54.28	55.50	59.45	60.66	59.56	65.05	67.71	67.42	52.87	67.71
3	SUMATERA BARAT	57.04	57.94	59.44	62.83	62.62	61.83	65.34	68.24	67.78	57.04	68.24
4	RIAU	62.10	62.98	63.64	67.74	67.29	66.35	70.57	73.47	72.40	62.10	73.47
5	JAMBI	58.68	58.49	60.08	64.29	64.75	64.06	67.32	69.64	69.23	58.49	69.64
6	SUMATERA SELATAN	53.66	56.48	57.01	61.12	60.70	60.68	64.53	66.25	66.23	53.66	66.25
7	BENGKULU	55.86	55.84	58.30	60.31	61.18	60.19	64.34	66.81	66.49	55.84	66.81
8	LAMPUNG	52.73	55.07	56.44	59.81	61.54	59.03	63.83	66.08	65.00	52.73	66.08
9	KEP. BANGKA BELITUNG	61.81	62.12	63.43	68.41	67.77	66.61	68.22	73.16	71.43	61.81	73.16
10	KEP. RIAU	74.17	73.77	73.35	74.11	76.39	74.33	81.83	79.88	80.37	73.35	81.83

Picture 2. Proportion of Mobile Device Ownership in Sumatra Area within 2015 - 2023

In Sumatra area, surprisingly Riau Island has the highest percentage of both devices within 2015-2023 compared to other nine provinces, even compare to the leading provinces such as North Sumatra and South Sumatra. Within 9 years in Riau Island ranges circa 27% - 31% for desktop as stated at Picture 1, while 73% up to 81% for mobile devices at Picture 2. Other Sumatra provinces ranges from 11% - 22% for desktop and 51% up to 73% for mobile devices.

No	Java, Bali, Nusa Tenggara	2015	2016	2017	2018	2019	2020	2021	2022	2023	MIN	MAX
1	DKI JAKARTA	36.95	35.66	35.40	32.24	30.00	34.19	36.29	36.83	39.15	30.00	39.15
2	JAWA BARAT	17.33	17.93	18.62	19.92	17.54	18.33	17.98	18.70	18.85	17.33	19.92
3	JAWA TENGAH	15.27	15.57	15.69	17.59	16.48	16.02	14.95	14.92	14.05	14.05	17.59
4	DI YOGYAKARTA	34.73	34.18	33.19	34.99	34.69	35.05	33.31	31.15	30.56	30.56	35.05
5	JAWA TIMUR	17.59	18.19	17.94	18.57	18.28	17.99	16.38	16.42	16.05	16.05	18.57
6	BANTEN	22.36	22.53	21.10	22.08	21.02	19.47	18.54	19.75	20.71	18.54	22.53
7	BALI	27.79	29.15	27.11	26.61	25.50	25.82	25.00	27.72	24.34	24.34	29.15
8	NUSA TENGGARA BARAT	12.58	13.46	12.36	13.68	12.74	12.43	11.75	11.06	11.09	11.06	13.68
9	NUSA TENGGARA TIMUR	11.52	12.03	12.68	13.57	13.56	13.94	14.22	13.92	13.65	11.52	14.22

Picture 3. Proportion of Desktop Ownership in Java, Bali, Nusa Tenggara Area within 2015 – 2023

No.	Java, Bali, Nusa Tenggara	2015	2016	2017	2018	2019	2020	2021	2022	2023	MIN	MAX
1	DKI JAKARTA	76.93	75.78	76.99	76.16	78.42	77.57	67.83	82.27	82.47	67.83	82.47
2	JAWA BARAT	59.50	60.99	62.55	65.01	66.24	64.83	62.76	70.37	68.87	59.50	70.37
3	JAWA TENGAH	54.97	56.41	57.62	60.47	61.66	60.87	62.76	65.15	64.74	54.97	65.15
4	DI YOGYAKARTA	64.79	64.57	65.73	68.32	67.66	67.62	69.81	70.37	71.37	64.57	71.37
5	JAWA TIMUR	55.29	57.21	58.30	60.66	62.16	61.82	62.99	65.22	64.60	55.29	65.22
6	BANTEN	60.49	60.92	61.63	64.25	65.21	64.40	68.20	70.25	69.87	60.49	70.25
7	BALI	63.77	65.19	66.24	67.99	69.61	69.93	71.65	72.82	73.20	63.77	73.20
8	NUSA TENGGARA BARAT	45.26	47.79	48.96	53.88	57.10	56.36	59.16	61.11	61.48	45.26	61.48
9	NUSA TENGGARA TIMUR	36.65	37.96	40.97	43.91	45.01	44.12	51.92	52.73	51.36	36.65	52.73

Picture 4. Proportion of Mobile Device Ownership in Java, Bali, Nusa Tenggara Area within 2015 – 2023.

In Java, Bali and Nusa Tenggara group even DKI Jakarta consistently every year takes a lead in percentage of mobile as well as desktop device, followed by DI Yogyakarta as stated in Picture 3 and picture 4. But NTB and NTT try to overtake their counterparts in the group, particularly in mobile devices. NTB growth is 36% and NTT 40% for mobile devices which placed them as the highest growth in the group.

Kalimantan area shows slightly decrease in desktop ownership circa -3% up to 12%. But growth at mobile devices ranges 10% - 35% which is placed West Kalimantan as the highest growth, followed by Central Kalimantan. However East Kalimantan takes a lead in 20223 in percentage of mobile device nearly 82% and nearly 30% in desktop.

Similar to Kalimantan, Sulawesi area shows nearly all decrease in desktop ownership except in Gorontalo with 7% increase. With -21% decrease, North Sulawesi rangks as the highest decrease in all provinces in Indonesian within 2015 – 2023. It is compensated with 18% growth in

mobile device. Overal mobile device growth in Sulawesi is quite good with min-max 18% - 45% which put West Sulawesi as the highest growh followed by Gorontalo.

The same story happens to Maluku and Papua area which shows all decrease in desktop ownership circa -7% up to -15%. But it is compensated with significant growth in mobile device circa 18% - 35% which placed North Maluku as 1st and 2nd rank in sequence. West Papua shows similar medium percentage of mobile and desktop device ownership like other provinces by year. This is a good sign that Papua island starts to equate itself with other provinces and open many opportunity for its people's development.

CONCLUSION AND SUGGESTION

From the above analysis can be concluded that blended learning education business sector can tap in through mobile device due to its significant growth at all provinces in Indonesia. However the platform of mobile device needs further research whether IOS, android, Symbian or any other operating system. But since there are quite good population of desktop users particularly in Java and Bali area, responsive website under windows might be the most suitable operating system. It can be used both for desktop device as well as nearly all type of mobile operating system.

Overall most prospective area reminds in Java island and Bali. But it is time to keep an eye on NTB and NTT due to their significant growth in mobile device ownership. This can be a good opportunity for Telco business player in building more BTS in this two provinces. The advantage is not only for education business but also the promising tourism business sector and its related business sector.

Since Papua, South Papua, Central Papua and Highland Papua province has the lowest percentage of mobile device ownership, it is the obgligation of the government to add more BTS at remote area. This will increase demand in mobile device ownership as the internet connection gets better. So the people will see the benefit by having mobile device for their communication, education, etc. However deeper research should be conducted in selecting exact provice among them which one needs critical assistance. Since the dataset of Papua, South Papua, Central Papua and Highland Papua are still under Papua province.

Even though desktop ownership is far less than mobile device ownership, it is still prospective to tap in densely populated provinces such as Java area and Bali. Since more than 60% of Indonesian population live in Jabodetabek. There is still a useful operating system named responsive website under windows for the rest of provinces to be implemented for blended learning. As it can be operated under both mobile and desktop platform.

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