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Menyasar SDGs No : 16 (Menguatkan masyarakat yang inklusif dan damai untuk pembangunan berkelanjutan, menyediakan akses keadilan untuk semua dan membangung kelembagaan yang efektif, akuntabel, dan inklusif di semua tingkatan.

LAPORAN AKHIR
PENELITIAN TALENTA USU
SKEMA KOLABORASI INTERNASIONAL

THE THREE-WAY INTERACTION METHOD OF *CRYPTOCURRENCY* RISK PREDICTION MODEL AROUND THE WORLD: PRESENT VALUE REALITY ASSET BASED ON MACROECONOMIC FACTORS AND INTERNAL RISKS FUNDAMENTAL AT THE MOMENT OF COVID-19

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RINGKASAN

Investasi pada asset digital atau *cryptocurrency* semakin marak di seluruh dunia, termasuk di Indonesia. Keputusan dalam memilih instrumen investasi dapat dilakukan dengan membeli saham perusahaan di Bursa Efek Indonesia dan pasar penjualan *cryptocurrency*. Keuntungan yang diharapkan adalah *return* yang diharapkan akan diperoleh oleh investor dimasa mendatang. Novelti yang dihasilkan berupa suatu konsep baru dalam investasi yang dinamakan *velocity of cryptocurrency*, variabel ini belum pernah diteliti dalam konsep manajemen investasi dan kedepannya diharapkan semakin banyak pihak yang akan mengembanhgkan penelitian tentang tingkat perputaran dan perpindahan *asset digital cryptocurrency*, kemudian model penilaian dan prediksi harga *asset digital cryptocurrency* berbasis faktor resiko fundamental dan fluktuasi harga komoditi dunia yang dinamakan *cryptocurrency risk prediction* model, dan *legal cryptocurrency and tax reveneu* yang dirumuskan dengan melaksanakan *focus group disscussion* tentang kebijakan pungutan pajak terhadap transaksi jual beli *asset digital cryptocurrency*. Populasi penelitian ini adalah 10 (sepuluh) coin *cryptocurrency* dengan *market caps* terbesar di Dunia dengan jenis data dalam penelitian ini adalah *pooled data* yang diambil dalam 1 tahun dari Januari sampai dengan Desember 2021, bertepatan dengan keadaan momen pandemi COVID-19 dengan mengambil data laporan transaksi mingguan *cryptocurrency* sehingga didapatkan target populasi sebanyak 520 observasi (52 minggu x 10 coin) selama 1 tahun. Data laporan transaksi mingguan yang menjadi sampel 520 data dalam penelitian ini. Analisis data dalam penelitian ini adalah untuk menganalisis faktor-faktor apakah yang mempengaruhi *Return* pada *Cryptocurrency* dengan tahapan yaitu statistik deskriptif, uji stasioneritas data, uji asumsi klasik, hipotesis moderating, model regresi *threeway interacttion and joint moderating effects regression analysis*, uji hipotesis penelitian. Penelitian ini adalah penelitian kolaborasi internasional yang merujuk *Sustainable Development Goals* dengan tujuan menguatkan masyarakat inklusif untuk pembangunan berkelanjutan di semua tingkatan. Luaran yang ditargetkan adalah publikasi jurnal Internasional bereputasi di *ABAC Journal Assumption University* (Q1), *Turkish Journal of Physiotherapy and Rehabilitation* (Q4), dan *proceeding* Internasional terindeks di *Global Conference on Business, Management and Entrepreneurship.*

Keyword: *cryptocurrency; world commodities price; internal risk fundamental factors, macroeconomics*

PRAKATA

Puji syukur senantiasa tim peneliti panjatkan atas kehadirat Allah Subhanahu Wa Ta'ala yang telah melimpahkan Rahmat-Nya, sehingga Penelitian Skema Kolaborasi Internasional ini dapat diselesaikan dengan lancar. Penelitian ini berjudul: The Three-Way Interaction Method of Cryptocurrency Risk Prediction Model Around The World: Present Value Reality Asset Based on Macroeconomic Factors and Internal Risks Fundamental at The Moment Of Covid-19.

Beberapa pihak telah memberikan bantuan dalam rangka penyelesaian laporan ini. Oleh karena itu, dalam kesempatan ini tim peneliti ingin menyampaikan penghargaan dan ucapan terimakasih yang sebesar-besarnya kepada pihak-pihak tersebut, yaitu:

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Medan, 24 Maret 2023

Tim Peneliti

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BAB I

PENDAHULUAN

1.1 Latar Belakang

Investasi merupakan suatu penanaman modal secara langsung atau tidak langsung, serta jangka pendek maupun jangka panjang dengan tujuan untuk memperoleh keuntungan yang diharapkan atau bentuk manfaat lainnya dari hasil penanaman modal itu sendiri. Berawal dari investasi tersebut ada suatu keuntungan (*return*) yang diinginkan. Hal ini dapat dilihat dari representasi *blockchain* yang dampaknya dapat dinikmati langsung oleh kalangan masyarakat (*consumer*), dan masih banyak potensi lain yang dapat dieksplorasi, sehingga ketertarikan terhadap mata uang kripto, umumnya sebagai instrumen investasi sebenarnya baru meningkat tajam pasca nilai tukar *Bitcoin* mengalami lonjakan yang cukup tinggi. *Cryptocurrency bitcoin* diproduksi melalui enkripsi data dan algoritme tertentu. *Cryptocurrency bitcoin* menggunakan sistem topologi *peer-to-peer* dan kurangnya administrasi tunggal, membuat nilainya tidak dapat dimanipulasi oleh otoritas atau pemerintah, serta tidak menyebabkan inflasi jika produksi *Bitcoin* bertambah banyak.

Keadaan tersebut ditambah dengan fakta bahwa di tahun 2020 tingkat pertumbuhan ekonomi dunia melemah cukup tajam namun posisi harga aset digital *cryptocurrency* masih tetap stabil dan bahkan mampu mencapai harga tertinggi selama satu dekade terakhir yaitu meningkat hingga 250% dari tahun sebelumnya. Tabel 1 menjelaskan data transaksi dan market capitalitation di negara yang melakukan transaksi terbesar pada *Cryptocurrency Bitcoin*, bahwa Indonesia adalah salah satu negara dengan jumlah transaksi aset digital terbesar didunia.

Tabel 1.1 Transaksi dan Market Capitalitation *Cryptocurrency*

Cryptocurrency	**Market Cap (USD) 31 Desember 2020**	**Market Cap (BTC) 31 Desember 2020**
Bitcoin	531.650.756.634.144	18.586.500.000001
Etherum	83.693.010.16243	2.925.612.939971

Source: BTC live CoinMarketCap 2021

Terlihat bahwa *market capitalization* beberapa *cryptocurrency* yang cukup besar nilainya, menggambarkan bahwa investasi pada instrument asset digital

cryptocurrency memiliki peluang keuntungan yang cukup besar, namun harus disertai dengan pengendalian risiko. Salah satu bagian terpenting dalam mempelajari investasi adalah bagaimana mengukur risiko dan return. Definisi risiko dan return tidak akan pernah sama antara satu investor dengan investor lainnya, bahkan tingkat kesukaan risiko dan *return* tidak akan pernah sama (Liu & Tsyvinski, 2018). Setiap investor yang ingin memaksimalkan kekayaan akan tertarik pada suatu investasi yang memberikan tingkat *expected return* yang lebih tinggi dibandingkan dengan peluang investasi lainnya. Keuntungan yang diharapkan (*expected Return*) adalah *return* yang diharapkan akan diperoleh oleh investor dimasa mendatang. Berdasarkan kenyataannya hampir semua investasi mengandung ketidakpastian atau risiko (Koskei, 2017).

Industri pertambangan menunjang perekonomian Indonesia dalam pendapatan dari pajak dan royalti penjualan dapat dialokasikan untuk menunjang pembangunan ekonomi (Apsara & Indriani, 2017). Indonesia juga merupakan salah satu negara dengan potensi cadangan mineral sangat tinggi yang menduduki posisi ke 24 sebagai negara pengekspor terbesar di dunia dengan ekspor komoditi bahan tambang terbesar di Indonesia didominasi oleh batu bara, timah, tembaga dan emas. Saham-saham perusahaan sub sektor pertambangan cenderung fluktuatif (Kaluge, 2019; Lento, Latif, & Verahastuti, 2019; Malla & Asianto, 2020). Namun, masuknya investor asing pada saham pertambangan turut mendorong minat investor lokal untuk turut membeli saham-saham tersebut yang akan menyebabkan kenaikan pada harga saham pertambangan (Komalasari, 2019). Tujuan penelitian berupa studi dokumentasi yang dimaksudkan dalam penelitian ini adalah mencari data sekunder. Oleh karena itu, mengikut spesifikasi skema penelitian, sesuai dengan Renstra USU yang menitik beratkan pada TALENTA yaitu berbasis *local wisdom* dengan memberikan bukti empiris tentang pengaruh faktor makro ekonomi yang akan memberikan dampak, baik berupa keuntungan maupun kerugian terhadap investor dalam proses transaksi *asset digital crypto.*

1.2 Rumusan Masalah

Berdasarkan latar belakang masalah yang telah diuraikan, maka rumusan masalah pada penelitian ini adalah:

1. Apakah *risk factor* dan *word commodity price* mempunyai pengaruh terhadap *return cryptocurrency*?
2. Apakah *risk factor* dan *word commodity price* mempunyai pengaruh terhadap *return cryptocurrency* dengan inflasi sebagai moderasi?
3. Apakah *risk factor* dan *word commodity price* mempunyai pengaruh terhadap *return cryptocurrency* dengan inflasi sebagai moderasi dan *velocity of cryptocurrency* sebagai *joint moderating effect*?

1.3 Tujuan Penelitian

Berdasarkan rumusan masalah penelitian, maka tujuan dari penelitian ini:

1. Untuk menganalisis pengaruh *risk factor* dan *word commodity price* terhadap *return cryptocurrency*.
2. Untuk menganalisis pengaruh *risk factor* dan *word commodity price* terhadap *return cryptocurrency* dengan inflasi sebagai moderasi.
3. Untuk menganalisis pengaruh *risk factor* dan *word commodity price* terhadap *return cryptocurrency* dengan inflasi sebagai moderasi dan *velocity of cryptocurrency* sebagai *joint moderating effect.*

1.4 Urgensi Penelitian

Mata uang digital (*cryptocurrency*) telah menjadi fenomena global yang dikenal kebanyakan orang. Sementara kebanyakan orang, bank, pemerintah dan banyak perusahaan lainnya belum sadar akan pentingnya *cryptocurrency*. Tingkat perkembangan *cryptocurrency* dari tahun ke tahun dinilai cukup signifikan. Perkembangan salah satu jenis *cryptocurrency* yang mempunyai nilai terbesar saat ini yaitu bitcoin, tidak hanya marak terjadi di luar negeri. Dengan adanya kontribusi dari harga komoditas pada sektor pertambangan ini dapat dijadikan sebagai acuan bagi para investor apabila ingin menginvestasikan dananya dalam indeks saham khususnya pada *world commodity price*.

1.5 Rencana Target Luaran

Tabel 1.2. Target Luaran

No.	Jenis Luaran*	Nama jurnal, Nama Konfrensi, Jenis KI, nama Produk, TTG, Model, Karyaseni, Judul Buku Ajar
	Luaran Wajib	
1.	Artikel di jurnal internasional	*ABAC Journal Assumption University*
2.	Artikel di jurnal nasional	
3.	Hak Kekayaan Intelektual	
4.	Artikel di prosiding internasional terindeks bereputasi	
	Luaran tambahan	
1.	Artikel di prosiding internasional	*International Conference on Business, Management, and Technology*
2.	Artikel di jurnal nasional	
3.	Hak Kekayaan Intelektual	
4.	Produk/TTG/model/karya seni	
5.	Buku	
6.	MoU/MoA	

BAB II

TINJAUAN PUSTAKA

2.1 *Market Microstructure Theory*

Struktur Mikro Pasar yaitu "*The study of the process and outcomes of exchanging assets under explicit trading rules*." Konsep O'Hara ini secara jelas menyatakan bahwa studi ini membahas bagaimana harga aset terbentuk di pasar dengan aturan perdagangan yang ada. Asmar, & Ahmad, (2011) mendefinisikan struktur mikro pasar sebagai studi tentang mekanisme perdagangan dan peraturan yang digunakan untuk mencapai perdagangan. Interaksi antar agen juga menjadi topik dalam mikro struktur pasar dan untuk Indonesia (Yohanes, 2009). Masing-masing agen mempunyai strategi dalam melakukan transaksi dimana fundamental menggunakan pendekatan *opportunity cost* kepemilikan saham dan analisa teknis menggunakan pendekatan analisa teknikal.

2.2 *Signaling Theory*

Signaling theory merupakan efek yang timbul dari pengumuman laporan keuangan yang ditangkap oleh para pemakai laporan keuangan (terutama investor). Signaling theory menyatakan bahwa perusahaan yang mampu menghasilkan keuntungan cenderung meningkatkan hutangnya karena tambahan bunga yang dibayarkan akan diimbangi dengan laba sebelum pajak (Ayem, 2016). *Signaling effect* dihasilkan oleh informasi baru, dan bukan oleh issue yang terjadi (Penman, & Reggiani, 2013). Jadi, suatu perusahaan dengan prospek yang sangat menguntungkan untuk menghindari penjualan saham, dan sebagai gantinya menghimpun modal baru yang dibutuhkan dengan menggunakan hutang baru meskipun hal ini akan menjadi rasio hutang di atas tingkat sasaran.

2.3 *Capital Asset Pricing Model*

Hal yang sangat penting yang perlu dilakukan oleh seorang investor adalah mempunyai kemampuan untuk mengestimasi return suatu sekuritas (Putra, et al. 2013). Oleh karena itu, terdapat suatu model yang dapat digunakan untuk mengestimasi return suatu saham sekuritas yaitu *Capital Asset Pricing Model* (CAPM). *Capital Asset Pricing Model* (CAPM) merupakan suatu model atau cara

untuk mengestimasikan nilai return suatu aset dengan membandingkan antara variabel return yang diterima dan risiko yang ditanggung.

2.4 *Management Risk*

Manajemen risiko menjadi lebih penting dalam sektor finansial dibandingkan dengan sektor perekonomian lainnya (Falkner, & Hiebl, 2015). Mankiw (2003) menjelaskan bahwa nilai tukar mata uang antara dua Negara adalah harga dari mata uang yang digunakan oleh penduduk negara tersebut untuk saling melakukan perdagangan antara satu sama lain. Ho dan Hung (2009) juga menggunakan beta conditional pada sentimen investor, default spread dan karakteristik saham dan kemudian menemukan bahwa sentimen investasi juga membantu menangkap dampak anomali dalam model harga saham dengan lebih baik. Kami juga akan menerapkan beta bersyarat yang bergantung pada ketidakpastian, karakteristik *cryptocurrency*, dan pengembalian Bitcoin.

2.5 *Economic Theory Of Regulation*

Regulasi perbankan di Indonesia secara umum diterapkan dalam peraturan Bank Indonesia melalui surat edarannya yang selalu diperbaharui atau diubah sesuai dengan kondisi dan situasi perbankan nasional. Menurut Siringoringo (2017) sebagai pengembang teori ekonomi regulasi (*economic theory of regulation*), regulasi merupakan tindakan penekanan kelompok yang menghasilkan hukum dan kebijakan untuk mendukung kalangan bisnis serta melindungi konsumen, pekerja, dan lingkungan.

2.6 *State of the art*

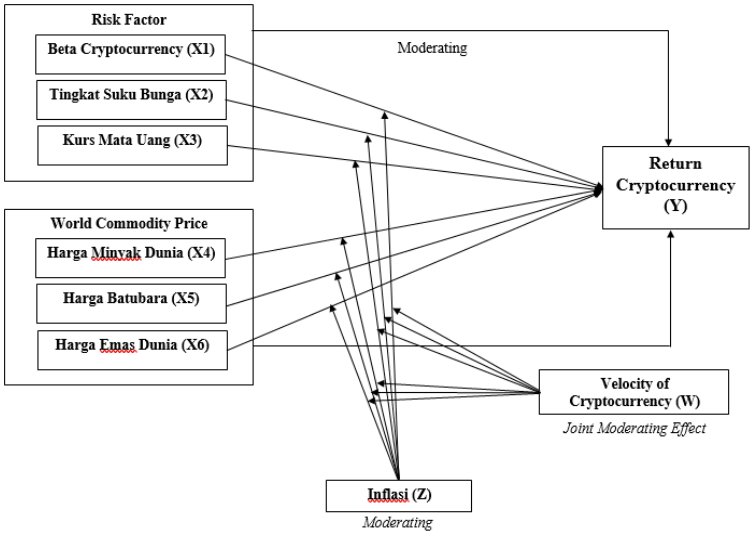
Tabel 2.1. *State of Art*

No	Judul dan Penelitian Terdahulu	Hasil Penelitian
1	"*Cryptocurrency* Return Assessment Model Based on Negative Risk Factors and Determinant Effect by Velocity of *Cryptocurrency* Pattern: an Emperical Objective Report from Indonesia *Cryptocurrency* Exchange" Isfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Ronnie Togar Mulia Sirait, Maulana	It was revealed that the velocity of *cryptocurrency* did not significantly affect the relationship of currency exchange rates to *cryptocurrency* returns, this happened because considering the determination of the rupiah exchange rate that adheres to a free-floating system is strongly influenced by the global economy and the amount of Indonesia's balance of payments, whether it is a

	Majied Sumatrani Saragih. (2021).	surplus or a deficit, so that even though the turnover rate is and the faster movement of crypto digital assets does not necessarily increase investment in the crypto digital asset market.
2	"Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On *Cryptocurrency* In Indonesia" Isfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Mangasih Sinurat, Saharudin. (2021).	The result the overall definition is sedimentary rock that may be burned, fashioned from organic deposits, mainly plant stays fashioned thru the coalification technique. the main elements are carbon, hydrogen and oxygen. the sector coal benchmark rate derived from trading Inte continental alternate marketplace (ICE) coming from the us and operates online all through the world.
3	"Investigation of the Bitcoin Effects on the Country Revenues via Virtual Tax Transactions for Purchasing Management" Rico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra, Wahyuddin Albr (2019).	As a new financial transaction system, crypto-currency using Bitcoin is a relatively new technology and needs further study. There are still many aspects in the banking world that need to be studied, the banking system is a complicated system with lots of financial control parameters.
4	"Comparative of the Supply Chain and Block Chains to Increase the Country Revenues via Virtual Tax Transactions and Replacing Future of Money" Rico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra (2019).	The position of Bitcoin that is still in the gray area causes the Indonesian Government to provide legal certainty to the phenomenon of Bitcoin that occurs in the community, which there are two options related to actions that can be carried out by the government.
5	"The Challenge in Application of *Cryptocurrency* as Commodity in Indonesia". Rico Nur Ilham, Khaira Amalia Fachrudin, Eben Ezer Pakpahan (2019).	Crypto Currency cannot be used as a means of payment and tools to trade goods and services in Indonesia. Crypto Asset or Virtual Currency has a legal basis to prohibit its use as a means of payment within the jurisdiction of Indonesia.
6	"The Effect of Risk factor and World Commodity Price in Indonesia Exchange *cryptocurrency* Return" Muammar Khaddafi, Rico Nur Ilham (2021).	This study will examine creating a return assessment model on cryptocurrency investment. Creating an investment strategy model that is able to avoid risks in cryptocurrency investments. Maximizing the potential for investing in the Indonesian cryptocurrency market which will be able to generate foreign exchange

		income for the State treasury with a tax collection scheme for crypto digital asset transactions (tax revenue).

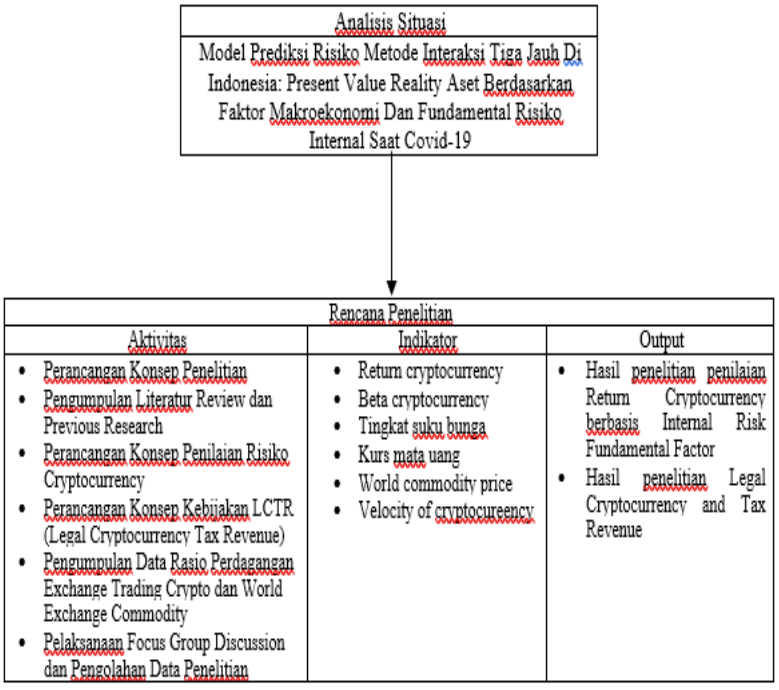
2.7 Kerangka Penelitian



Gambar 2.1. Kerangka Penelitian

2.8 *Roadmap* Penelitian

Berikut ini adalah *roadmap* penelitian penilaian *return* investasi *asset digital crypto* berbasis *risk factor*:



Gambar 2.2. *Roadmap* Penelitian

BAB III

METODE PENELITIAN

3.1 Jenis Penelitian

Jenis penelitian ini adalah deskriptif kuantitatif dan explanatory research, yaitu penelitian yang menjelaskan hubungan kausal, sebab-akibat antara variabel independen dengan variabel dependen.

3.2 Populasi dan Sampel

Populasi penelitian ini adalah sepuluh coin *Cryptocurrency* dengan market caps terbesar di Indonesia, yaitu Bitcoin (BTH), Ethereum (ETH), Ripple (XRP), Bitcoin Cash (BCH), Litecoin (LTC), Stellar, DASH, Dogecoin, Zcash, Monero di Indonesia. Jenis data dalam penelitian ini adalah Pooled Data (Data Panel) yang diambil dari Januari 2020-Desember 2021 bertepatan dengan keadaan momen pandemic covid-19 dengan melakukan studi dokumentasi yang dilakukan atas publikasi laporan transaksi mingguan *cryptocurrency* sehingga didapatkan target populasi sebanyak 520x1 tahun, dimana observasi data laporan transaksi mingguan yang menjadi sampel data sebanyak 520 minggu pada tahun 2020 dan 2021.

3.3 Teknik dan Penelitian

Teknik pengumpulan data primer dan sekunder dalam penelitian ini adalah Studi Dokumentasi berupa data *return cryptocurrency, beta cryptocurrency*, tingkat suku bunga, kurs mata uang, harga minyak dunia, harga batubara, harga emas dunia, inflasi dan *velocity of cryptocurrency* yang diperoleh dari Blockchain.info dan *Exchange* online lainnya. Data yang digunakan dalam penelitian ini merupakan data transaksi mingguan yang dimulai dari Januari sampai dengan Desember 2020 pada masa pandemic covid-19. Salah satu situs utama dalam pengumpulan data dalam penelitian ini yatiu www.indodax.com dan www.coin-geco.com yang menyediakan langsung jasa *exchange cryptocurrency*.

Penelitian ini menggunakan metode *explanatory case study* untuk menjelaskan pengaruh antar variabel yang digunakan dalam penelitian ini melalui pengujian

hipotesis penelitian yang telah ditetapkan. Sedangkan teknik yang digunakan adalah *Pooled Data*.

1. Teknik Analisis Data

Analisis data kuantitatif dalam penelitian ini adalah untuk menganalisis faktor-faktor apakah yang mempengaruhi *return* pada *cryptocurrency*. Sebelum membuat kesimpulan dalam suatu penelitian analisis terhadap data harus dilakukan agar hasil penelitian menjadi akurat. Maka penelitian ini dilakukan dengan metode statistik yang dibantu program E-VIEWS 10. Analisis dalam penelitian ini menggunakan data panel yang merupakan gabungan antara data deret waktu (*time-series*) dan data deret lintang (*crosssection*).

Berikut ini persamaan regresi Model Panel Multiple Regression Analysis yang akan digunakan dalam penelitian ini adalah sebagai berikut:

Persamaan: Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7Z + b8W+ ei

Berikut ini persamaan regresi Model Three way Interacttion And Joint Moderating Effects Regression Analysis yang akan digunakan dalam penelitian ini adalah sebagai berikut:

Persamaan: Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7Z + b8W + b9X1Z + b9X2.*Z + b10X3*Z + b11X4*Z + b12X5*Z + b13X6*Z + b14X1*W + b15X2*W + b16X3*W + b17X4*W + b18X5*W + b19X6*W + b20Z*W + b21X1Z*W + b22X2.Z*W + b23X3Z*W + b24X4Z*W + b25X5Z*W + b26X6Z*W + ei

Dimana:

Y = *Return Cryptocurrency*

X_1 = *Beta Cryptocurrency*

X_2 = Tingkat Suku Bunga

X_3 = Kurs Mata Uang

X_4 = Harga Minyak Dunia

X_5 = Harga Batu Bara

X_6 = Harga Emas Dunia

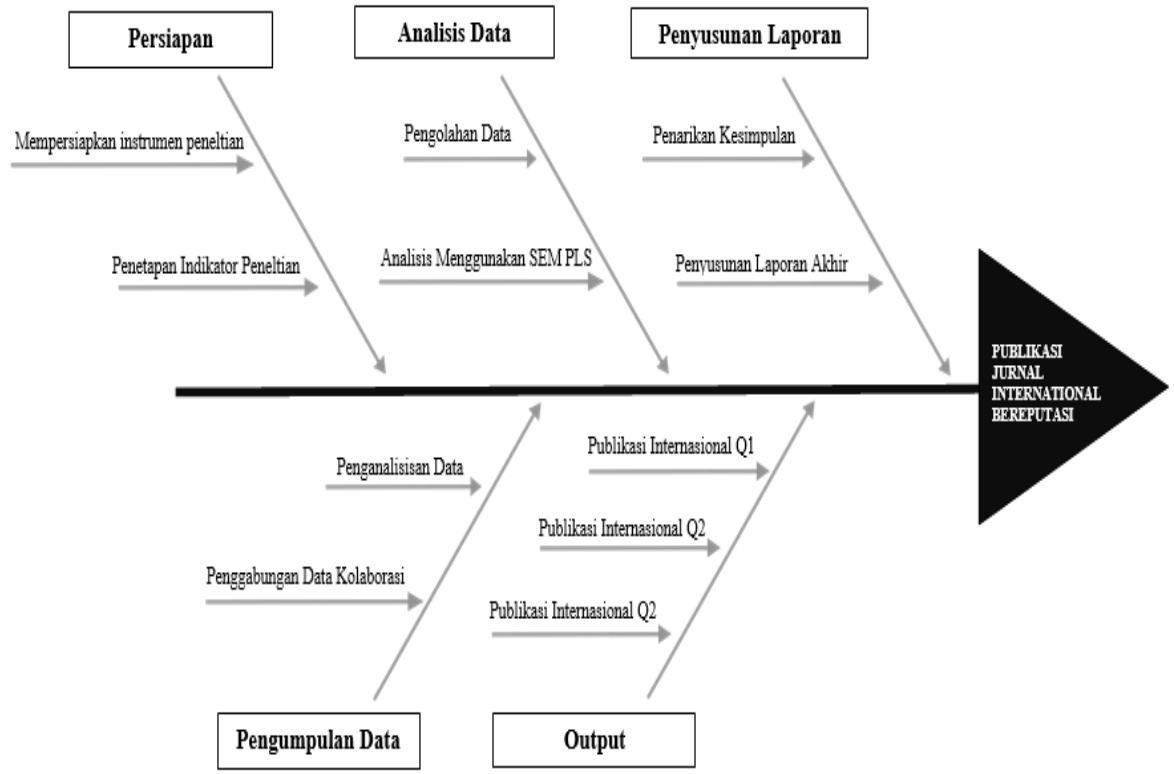
Z = Inflasi

W = Velocity of *Cryptocurrency*

b_0 = Konstanta

b_1-b_{26} = Koefisien Regresi

3.4 *Fish Bone* Penelitian



Gambar 3.1. *Fish Bone* Penelitian

3.5 Susunan Organisasi Tim Pengusul dan Pembagian Tugas

Tabel 3.1. Pembagian Tugas Tim Peneliti

No.	Nama /NIDN/NIP	Fakultas/Unit	Bidang Ilmu	Uraian Tugas
1	Dr. Nisrul Irawati, MBA/NIDN 0004126207	Sekolah Pascasarjana	Manajemen Keuangan	1. Membuat fenomena penelitian 2. Pengambilan dan analisis data 3. Penulisan laporan penelitian
2	Prof. Dr. Isfenti Sadalia, SE, ME / NIDN 0019106702	Sekolah Pascasarjana	Manajemen Keuangan	1. Pra survey penelitian 2. Penyusunan

				instrumen penelitian 3. Pengambilan data yang relevan
3	Beby Kendida Hasibuan, SE, M.Si / NIDN 0008108302	Fakultas Ekonomi dan Bisnis	Manajemen Keuangan	1. Pra survey penelitian 2. Penyusunan instrumen penelitian 3. Pengambilan data yang relevan
4	Yasmin Chairunisa Muchtar, SP, MBA / NIDN 0030097803	Fakultas Ekonomi dan Bisnis	Kewirausahaan	1. Pra survey penelitian 2. Penyusunan instrumen penelitian 3. Pengambilan data yang relevan

BAB IV

HASIL DAN PEMBAHASAN

4.1 Hasil Analisis Data

Untuk melihat mendapatkan model yang baik dalam analisis regresi data panel, maka diperlukan teknik pemilihan model. Penelitian ini menggunakan teknik analisis regresi data panel, yaitu gabungan dari data runtut waktu (*time-series*) dan data deret lintang (*Cross-section*). Regresi data panel terdiri dari 3 model yaitu *Common Effect Model* (CEM), *Fixed Effect Model* (FEM) dan *Random Effect Model* (REM). Adapun hasil pengujian ketiga model tersebut dalam penelitan ini adalah sebagai berikut:

Tabel 4.1. Hasil Pengujian Data Panel Ketiga Model

Variabel	Common Effect Model (CEM)		Fixed Effect Model (FEM)		Random Effect Model (REM)	
	koefisien	Sig	koefisien	Sig	koefisien	Sig
C	23.41343	0.000	20.13412	0.022	19.03828	0.000
Beta Cryptocurrency (X1)	2.121424	0.005	1.652355	0.008	1.049001	0.012
Tingkat Suku Bunga (X2)	2.343441	0.012	2.241345	0.011	3.091883	0.033
Kurs Mata Uang (X3)	1.525222	0.031	2.121244	0.021	1.009381	0.041
Harga Minyak Dunia (X4)	1.024583	0.000	1.521435	0.004	2.262800	0.047
Harga Batu Bara (X5)	5.049237	0.011	2.004544	0.022	1.412722	0.019
Harga Emas Dunia (X6)	1.903856	0.023	2.041222	0.019	1.462721	0.051
Inflasi (Z)	3.120529	0.033	3.162464	0.027	2.946272	0.049
Velocity of *Cryptocurrency* (W)	1.542386	0.009	2.142356	0.008	1.093877	0.048

Sumber : Output Eviews (Data Diolah), 2022

Berdasarkan tabel diatas, terlihat seluruh nilai koefisien dan signifikansi Untuk model regresi data panel berdasarkan *Common Effect Model* (CEM), *Fixed Effect Model* (FEM) dan *Random Effect Model* (REM) didalam penelitian ini.

1. Uji Chow

Uji chow (*Chow test*) merupakan pengujian yang dilakukan untuk memilih model yang paling baik antara *Common Effect Model* (CEM) dan *Fixed effect model* (FEM). Jika hasil uji chow signifikan (*probability* < 0,05) maka model yang terpilih adalah FEM dan apabila hasil uji chow signifikan (*probability* > 0,05) maka model yang terpilih adalah CEM.

Tabel 4.2. Hasil Uji Chow

Effects Test	Statistic	d.f.	Prob.
Cross-section F	8.841248	(65,190)	0.0000
Cross-section Chi-square	211.842741	520	0.0000

Sumber: hasil penelitian, 2022

Berdasarkan tabel uji chow, menunjukkan bahwa nilai *probability* pada uji chow sebesar 0,0000. Nilai tersebut berada di bawah nilai standar toleransi kesalahan di dalam penelitian ini yaitu 0,05. Maka dari itu, berdasarkan hasil uji chow model terbaik di dalam penelitian ini adalah model *Fixed effect model* (FEM).

2. Uji Hausman

Uji selanjutnya yang akan digunakan adalah uji hausman (*hausman test*). Uji hausman merupakan uji membandingkan antara *Fixed effect model* (FEM) dan *Random Effect Model* (REM). Jika nilai *probability* berada di bawah nilai level kesalahan yaitu 0,05 maka model yang terbaik adalah *Fixed effect model* (FEM) sedangkan jika nilai *probability* berada di atas nilai level kesalahan yaitu 0,05 maka model yang terbaik adalah *Random Effect Model.*

Tabel 4.3. Hasil Uji Hausman

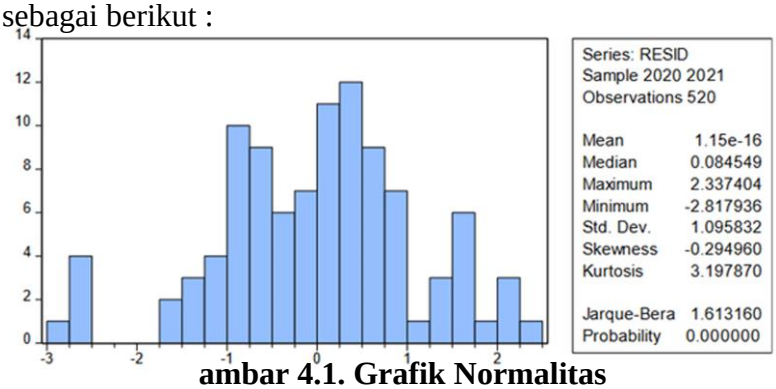
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.263449	6	0.9138

Sumber: hasil penelitian, 2022

Berdasarkan tabel uji hausman diatas, terlihat bahwa nilai *probability* pada uji Hausman sebesar 0.9138. Nilai tersebut berada di atas nilai standar toleransi kesalahan di dalam penelitian ini yaitu 0,05. Maka dari itu, model regresi data panel yang terbaik dalam penelitian ini adalah *Random Effect Model* (REM).

3. Data Normality Test

Uji normalitas digunakan untuk menguji apakah model regresi mempunyai distribusi normal atau tidak. Asumsi normalitas merupakan persyaratan yang sangat penting pada pengujian kebermaknaan (signifikansi), signifikan yang digunakan sebesar α = 5% Uji normalitas yang dilakukan dalam penelitian ini adalah uji Jarque-Bera. Adapun hasil uji Jarque-Bera pada penelitian ini adalah akan terlihat sebagai berikut :



ambar 4.1. Grafik Normalitas

Berdasarkan gambar diatas, terlihat bahwa nilai uji Jarque-Bera sebesar 1.613160 dan nilai *Probability* pada sebesar 0,000000 dimana nilai tersebut berada dibawah dari nilai standar toleransi kesalahan (5%). Oleh karena itu, dapat disimpulkan bahwa residual terdistribusi normal.

4. The heteroscedasticity Test

Uji heteroskedastisitas bertujuan untuk menguji apakah dalam model regresi terjadi ketidaksamaan *variance* dan residual satu pengamatan yang lain, jika *variance* dari residual satu pengamatan yang lain tetap maka disebut homoskedastisitas, dan jika berbeda disebut heteroskedastisitas (Ghozali, 2012:101). Model regresi yang baik adalah yang homoskedastisitas atau tidak terjadi heteroskedastisitas.

Tabel 4.4. Hasil Uji Heteroskedastisitas

Dependent Variable: RESABS
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.01248	11.31422	3.143555	0.0000

BETA_CRYPTOCURRENCY_X1	2.028424	0.312424	1.039593	0.1411
TINGKAT_SUKU_BUNGA_X2	1.135013	2.604393	1.131153	0.0856
KURS_MATA_UANG_X3	2.413424	3.053531	3.004124	0.166
HARGA_MINYAK_DUNIA_X4	1.013842	0.11412	0.114401	0.513
HARGA_BATU_BARA_X5	-3.013492	2.256335	0.412442	0.4125
HARGA_EMAS_DUNIA_X6	2.023533	3.513534	-3.01349	0.0855
INFLASI_Z	-1.41222	1.535333	-1.14552	0.1384
VELOCITY_OF_CRYPTOCURRENCY_W	2.410422	4.246332	1.110533	0.6241

Effects Specification		
	S.D.	Rho
Cross-section random	13.13745	0.1577
Idiosyncratic random	20.53001	0.6043

Sumber : Output Eviews (Data (2022)

Berdasarkan tabel di atas, terlihat bahwa seluruh variabel bebas pada uji *Glajser* berada diatas 0,05.

5. Multicollinearity Test

Uji Multikolinieritas bertujuan dalam pengujian apakah dalam regresi ditemukan adanya korelasi antara variabel-variabel bebas (Independen). Jika matrik korelasi antar variabel independen tersebut dibawah 0.8 maka tidak terjadi multikolinearitas, sedangkan jika korelasi antar variabel independen tersebut diatas 0.8 maka terjadi multikolinearitas. Berikut tabel matrik hasil pengujian multikolinearitas pada penelitian ini.

Table 4.5. Multicollinearity Test Result

	R_C_Y	B_C_X1	T_S_B_X2	K_M_U_X3	H_M_D_X4	H_B_B_X5	H_E_D_X6	I_Z	V_C_W
R_C_Y	1000000	-0.241233	-0.120152	0,7235733	-1.021385	0.352385	0.736433	-0.05931	0.513444
B_C_X1	-0.084744	1000000	0.4000	0.517533	-0.12414	0.523255	-0.52303	-1.23039	0.134144
T_S_B_	-	0.462	10000	0.5315	0.6254	-	0.4242	0.64	0.642

X2	0.038 44	6525	00	3	1	1.73742 2	42	514	62
K_M_U _X3	0.013 843	0,654 122	0,461 2742	10000 00	0.7451 13	0.42742 4	0.7256 5	0.13 133	- 1.099 13
H_M_D _X4	0,736 111	0,152 422	0.174 24	0.5153 13	10000 00	0.64124	0.6414	0.43 1545	0.417 14
H_B_B_ X5	0,413 422	- 0.012 84	- 0.742 62	- 0.6254 12	- 0.5153 1	100000 0	- 0.6418 2	- 1.02 194	- 0.123 51
H_E_D_ X6	0,262 444	- 1.736 43	0.642 72	- 1.0198 3	- 0.3553 3	0.43216 41	100000 0	0.46 212	- 0.412 4
I_Z	0,624 62	0.017 343	- 0.427 22	0.5143 3	0.7615 35	- 0.74272	- 0.6426 4	1000 000	- .4124 61
V_C_W	- 1,081 373	0.412 742	- 1.427 422	0.5618 13	0.5143 5	- 0.42641 4	- 1.4264 2	0.11 091	1000 000

Sumber : Output Eviews (Data Diolah), 2022

Menunjukkan bahwa model ini tidak terjadi gejala multikolinieritas dengan melihat *output* antara variabel independen dalam regresi tidak terdapat *output* yang melebihi 0.8.

6. Uji Autokorelasi

Uji autokorelasi bertujuan untuk menguji dalam suatu model ada atau tidaknya korelasi antara kesalahan pengganggu pada periode t dengan kesalahan pada periode t-1. Ghozali (2012:124) menyatakan bahwa model regresi yang baik adalah model yang tidak terdapat autokorelasi di dalamnya.

Tabel 4.6. Hasil Uji Autokorelasi

R-squared	0.084133	Mean dependent var	8.412424
Adjusted R-squared	3.013422	S.D. dependent var	10.24124
S.E. of regression	13.39393	Sum squared resid	427436.2
F-statistic	9.124012	Durbin-Watson stat	1.901831
Prob(F-statistic)	0.004235		

Sumber : Output Eviews (Data Diolah), 2022

Uji autokorelasi dapat dilihat dari nilai *Durbin Watson* di dalam penelitian ini. Nilai *Durbin Watson* di dalam penelitian ini sebesar 1.901831 dan jumlah

sampel 520 (n), jumlah variabel independen 6 (k=2), maka nilai Durbin-Watson, DW 1.901831 lebih besar dari batas atas (du) 1,8000 dan kurang (dl) 1,4029, dengan nilai table pada tingkat signifikansi 5%, maka dapat disimpulkan bahwa tidak terdapat autokorelasi pada model regresi ini, atau perhitungan dapat disimpulkan bahwa nilai DW terletak pada daerah uji. dengan nilai batas atas (du) 1,8000 dan batas bawah (dl) 1,4029.

7. Multiple Linear Regression Model

Model regresi linear berganda adalah model pengujian statistik yang bertujuan untuk menganalisis pengaruh variabel independen terhadap variabel dependen. Berdasarkan pemilihan model di atas, maka model terbaik adalah *Random Effect Model* (REM). Adapun hasil regresi data panel dengan *Random Effect Model* (REM) adalah sebagai berikut :

Table 4.7. Multiple Linear Regression Model Result

Dependent Variable: Return_Cryptocurrency_Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.41241	8.312424	6.143555	0.0000
BETA_CRYPTOCURRENCY_X1	1.525215	0.039595	2.634642	0.0053
TINGKAT_SUKU_BUNGA_X2	2.837466	2.413356	1.903953	0.0011
KURS_MATA_UANG_X3	3.185686	4.029455	3.385232	0.0102
HARGA_MINYAK_DUNIA_X4	1.277557	0.058236	0.745233	0.5303
HARGA_BATU_BARA_X5	-2.47457	2.241395	-1.52763	0.3722
HARGA_EMAS_DUNIA_X6	3.745556	4.620494	2.098527	0.0032
INFLASI_Z	-1.53513	2.254123	-1.41234	0.2505
VELOCITY_OF_CRYPTOCURRENCY_W	3.028722	6.105992	1.005224	0.3124
BETA_CRYPTOCURRENCY_X1_INFLASI_Z	2.824741	0.632781	4.039714	0.0000
TINGKAT_SUKU_BUNGA_X2_INFLASI_Z	0.815378	1.423019	2.013933	0.0022
KURS_MATA_UANG_X3_INFLASI_Z	0.637333	1.241555	1.746128	0.2225
HARGA_MINYAK_DUNIA_X4_INFLASI_Z	1.009427	2.031831	0.636212	0.4166
HARGA_BATU_BARA_X5_INFLASI_Z	2.612621	0.830392	0.641252	0.5011

HARGA_EMAS_DUNIA_X6_ INFLASI_Z	3.037381	1.531617	2.475163	0.0009
BETA_CRYPTOCURRENCY_X1_ VELOCITY_OF_CRYPTOCURRENCY_W	4.173733	1.028284	2.021384	0.0034
TINGKAT_SUKU_BUNGA_X2_ VELOCITY_OF_CRYPTOCURRENCY_W _Z	2.127281	1.412627	3.042948	0.0000
KURS_MATA_UANG_X3_ VELOCITY_OF_CRYPTOCURRENCY_W	1.029474	2.029481	2.472825	0.0014
HARGA_MINYAK_DUNIA_X4_ VELOCITY_OF_CRYPTOCURRENCY_W	1.048211	0.626261	0.726421	0.4255
HARGA_BATU_BARA_X5_ VELOCITY_OF_CRYPTOCURRENCY_W	0.743216	2.048272	3.402842	0.0000
HARGA_EMAS_DUNIA_X6_ VELOCITY_OF_CRYPTOCURRENCY_W	0.973263	1.042811	1.764272	0.2498
BETA_CRYPTOCURRENCY_X1_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.013939	2.041384	1.049393	0.6331
TINGKAT_SUKU_BUNGA_X2_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.743164	1.014384	2.039399	0.0025
KURS_MATA_UANG_X3_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.041938	0.351723	2.841293	0.0008
HARGA_MINYAK_DUNIA_X4_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	0.636421	2.417390	1.031893	0.4133
HARGA_BATU_BARA_X5_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.427330	1.043938	3.134636	0.0000
HARGA_EMAS_DUNIA_X6_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.903877	1.041381	1.484346	0.4184
R-squared	0.641242	Mean dependent var		8.413422
Adjusted R-squared	0.590921	S.D. dependent var		11.424222

S.E. of regression	17.042922	Sum squared resid	4.192829
F-statistic	7.094813	Durbin-Watson stat	3.004728
Prob(F-statistic)	0.000109		

Unweighted Statistics

R-squared	0.415362	Mean dependent var	14.09383
Sum squared resid	141523.55	Durbin-Watson stat	2.732853

Sumber : Output Eviews (Data Diolah), 2022

Berdasarkan tabel di atas, maka model persamaan regresi yang dapat disusun di dalam penelitian ini adalah sebagai berikut : *Return Cryptocurrency* = 21.412 + 1.525 *Beta Cryptocurrency* (X1) + 2.837 Tingkat Suku Bunga (X2) + 3.185 Kurs Mata Uang (X3) + 1.277 Harga Minyak Dunia (X4) – 2.474 Harga Batu Bara (X5) + 3.745 Harga Emas Dunia (X6) -1.535 Inflasi (Z) + 3.028 *Velocity of Cryptocurrency* (W) + 2.824 *Beta Cryptocurrency* (X1)_ Inflasi (Z) + 0.8153 Tingkat Suku Bunga (X2)_Inflasi (Z) + 0.6373 Kurs Mata Uang (X3)_ Inflasi (Z) + 1.009 Harga Minyak Dunia (X4)_Inflasi (Z) + 2.6126 Harga Batu Bara (X5)_Inflasi (Z) + 3.037 Harga Emas Dunia (X6)_Inflasi (Z) + 4.173 *Beta Cryptocurrency* X1_ *Velocity of Cryptocurrency* (W) + 2.127 Tingkat Suku Bunga (X2)_*Velocity of Cryptocurrency* (W) + 1.029 Kurs Mata Uang (X3)_ *Velocity of Cryptocurrency* (W) + 1.048 Harga Minyak Dunia (X4)_ *Velocity of Cryptocurrency* (W) + 0.743 Harga Batu Bara (X5)_ *Velocity of Cryptocurrency* (W) + 0.973 Harga Emas Dunia (X6)_ *Velocity of Cryptocurrency* (W) + e

8. The t test Method

Uji t digunakan untuk melihat pengaruh variabel independen terhadap variabel dependen secara parsial. Hasil pengujian hipotesis yang dilakukan, dapat disimpulkan bahwa uji parsial dalam penelitian ini layak digunakan apabila kriteria pengambilan keputusannya dengan nilai t_{tabel} kemudian juga melihat nilai probability.

Table 4.8. Hypotesist Test Result

Dependent Variable: Return_Cryptocurrency_Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.41241	8.312424	6.143555	0.0000
BETA_CRYPTOCURRENCY_X1	1.525215	0.039595	2.634642	0.0053
TINGKAT_SUKU_BUNGA_X2	2.837466	2.413356	1.903953	0.0011
KURS_MATA_UANG_X3	3.185686	4.029455	3.385232	0.0102
HARGA_MINYAK_DUNIA_X4	1.277557	0.058236	0.745233	0.5303
HARGA_BATU_BARA_X5	-2.47457	2.241395	-1.52763	0.3722
HARGA_EMAS_DUNIA_X6	3.745556	4.620494	2.098527	0.0032
INFLASI_Z	-1.53513	2.254123	-1.41234	0.2505
VELOCITY_OF_CRYPTOCURRENCY_W	3.028722	6.105992	1.005224	0.3124
Hasil Efek Moderating				
BETA_CRYPTOCURRENCY_X1_INFLASI_Z	2.824741	0.632781	4.039714	0.0000
TINGKAT_SUKU_BUNGA_X2_INFLASI_Z	0.815378	1.423019	2.013933	0.0022
KURS_MATA_UANG_X3_INFLASI_Z	0.637333	1.241555	1.746128	0.2225
HARGA_MINYAK_DUNIA_X4_INFLASI_Z	1.009427	2.031831	0.636212	0.4166
HARGA_BATU_BARA_X5_INFLASI_Z	2.612621	0.830392	0.641252	0.5011
HARGA_EMAS_DUNIA_X6_INFLASI_Z	3.037381	1.531617	2.475163	0.0009
BETA_CRYPTOCURRENCY_X1_VELOCITY_OF_CRYPTOCURRENCY_W	4.173733	1.028284	2.021384	0.0034
TINGKAT_SUKU_BUNGA_X2_VELOCITY_OF_CRYPTOCURRENCY_W _Z	2.127281	1.412627	3.042948	0.0000
KURS_MATA_UANG_X3_VELOCITY_OF_CRYPTOCURRENCY_W	1.029474	2.029481	2.472825	0.0014
HARGA_MINYAK_DUNIA_X4_VELOCITY_OF_CRYPTOCURRENCY_W	1.048211	0.626261	0.726421	0.4255
HARGA_BATU_BARA_X5_VELOCITY_OF_CRYPTOCURRENCY_W	0.743216	2.048272	3.402842	0.0000
HARGA_EMAS_DUNIA_X6_VELOCITY_OF_CRYPTOCURRENCY_W	0.973263	1.042811	1.764272	0.2498
Hasil Joint Efek Moderating				

BETA_CRYPTOCURRENCY_X1_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.013939	2.041384	1.049393	0.6331
TINGKAT_SUKU_BUNGA_X2_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.743164	1.014384	2.039399	0.0025
KURS_MATA_UANG_X3_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.041938	0.351723	2.841293	0.0008
HARGA_MINYAK_DUNIA_X4_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	0.636421	2.417390	1.031893	0.4133
HARGA_BATU_BARA_X5_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.427330	1.043938	3.134636	0.0000
HARGA_EMAS_DUNIA_X6_ INFLASI_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.903877	1.041381	1.484346	0.4184

R-squared	0.641242	Mean dependent var	8.413422
Adjusted R-squared	0.590921	S.D. dependent var	11.424222
S.E. of regression	17.042922	Sum squared resid	4.192829
F-statistic	7.094813	Durbin-Watson stat	3.004728
Prob(F-statistic)	0.000109		

Unweighted Statistics

R-squared	0.415362	Mean dependent var	14.09383
Sum squared resid	141523.55	Durbin-Watson stat	2.732853

Sumber : Output Eviews (Data Diolah), 2022

Pengujian uji t parsial adalah untuk menguji apakah ada pengaruh positif atau untuk mengetahui signifikansi masing-masing variabel secara sendiri-sendiri, sehingga bisa diketahui apakah dugaan yang sudah ada dapat diterima atau ditolak.

a. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari *Beta Cryptocurrency* (X1) sebesar 2.634642 dengan

signifikan 0.0053. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat *Beta Cryptocurrency* (X1) berpengaruh Positif dan signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (2.634642) > t_{tabel} (1.99254) dan nilai signifikan 0.0053 < 0.05. Sehingga dapat disimpulkan bahwa variabel *Beta Cryptocurrency* (X1) berpengaruh positif dan signifikan terhadap *Return Cryptocurrency* (Y). Hasil penelitian ini sejalan dengan penelitian yang dilakukan Isfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Ronnie Togar Mulia Sirait, Maulana Majied Sumatrani Saragih. (2021), berjudul *Cryptocurrency* Return Assessment Model Based on Negative Risk Factors and Determinant Effect by Velocity of *Cryptocurrency* Pattern: an Emperical Objective Report from Indonesia *Cryptocurrency* Exchange.

b. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari Tingkat Suku Bunga (X2) sebesar 1.903953 dengan signifikan 0.0011. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat Tingkat Suku Bunga (X2) berpengaruh Positif dan tidak signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (1.903953) < t_{tabel} (1.99254) dan nilai signifikan 0.0011 < 0.05. Sehingga dapat disimpulkan bahwa variabel Tingkat Suku Bunga (X2) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini tidak sejalan dengan penelitian yang dilakukan oleh Rico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra, Wahyuddin Albr (2019). Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On *Cryptocurrency* In Indonesia.

c. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari Kurs Mata Uang (X3) sebesar 3.385232 dengan signifikan 0.0102. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat Kurs Mata Uang (X3) berpengaruh Positif dan signifikan terhadap

Return Cryptocurrency (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (3.385232) > t_{tabel} (1.99254) dan nilai signifikan 0.0102 < 0.05. Sehingga dapat disimpulkan bahwa variabel Kurs Mata Uang (X3) berpengaruh signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini sejalan dengan penelitian yang dilakukan oleh Muammar Khaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange *cryptocurrency* Return.

d. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari Harga Minyak Dunia (X4) sebesar 0.745233 dengan signifikan 0.5303. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat Harga Minyak Dunia (X4) berpengaruh Positif dan signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (0.745233) < t_{tabel} (1.99254) dan nilai signifikan 0.5303 > 0.05. Sehingga dapat disimpulkan bahwa variabel Harga Minyak Dunia (X4) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini sejalan dengan penelitian yang dilakukan oleh Muammar Khaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange *cryptocurrency* Return.

e. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari Harga Batu Bara (X5) sebesar -1.52763 dengan signifikan 0.3722. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat Harga Batu Bara (X5) berpengaruh negatif dan tidak signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (-1.52763) < t_{tabel} (1.99254) dan nilai signifikan 0.3722 > 0.05. Sehingga dapat disimpulkan bahwa variabel Harga Batu Bara (X5) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini sejalan dengan penelitian yang dilakukan oleh Muammar Khaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange *cryptocurrency* Return.

f. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui

bahwa nilai t_{hitung} dari Harga Emas Dunia (X6) sebesar 2.098527 dengan signifikan 0.0032. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat Harga Emas Dunia (X6) berpengaruh positif dan signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (2.098527) > t_{tabel} (1.99254) dan nilai signifikan 0.0032 > 0.05. Sehingga dapat disimpulkan bahwa variabel Harga Emas Dunia (X6) berpengaruh signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini sejalan dengan penelitian yang dilakukan oleh Muammar Khaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange *cryptocurrency* Return.

g. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari Inflasi (Z) sebesar -1.41234 dengan signifikan 0.2505. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat Inflasi (Z) berpengaruh negatif dan tidak signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (-1.41234) < t_{tabel} (1.99254) dan nilai signifikan 0.2505 > 0.05. Sehingga dapat disimpulkan bahwa variabel Inflasi (Z) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini sejalan dengan penelitian yang dilakukan oleh Rico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra (2019). Comparative of the Supply Chain and Block Chains to Increase the Country Revenues via Virtual Tax Transactions and Replacing Future of Money.

h. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai t_{hitung} dari *Velocity of Cryptocurrency* (W) sebesar 1.005224 dengan signifikan 0.3124. Adapun nilai t_{tabel} didalam penelitian ini dihitung dengan df = 520-k (514) adalah sebesar 1.99254 dengan signifikan 0.05. Maka dapat dilihat *Velocity of Cryptocurrency* (W) berpengaruh positif dan tidak signifikan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai t_{hitung} (1.005224) < t_{tabel} (1.99254) dan nilai signifikan 0.3124 > 0.05. Sehingga dapat disimpulkan bahwa variabel *Velocity of Cryptocurrency* (W)

berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y). Penelitian ini sejalan dengan penelitian yang dilakukan oleh Isfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Mangasih Sinurat, Saharudin. (2021). Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On *Cryptocurrency* In Indonesia.

9. Uji F (Simultan)

Uji F digunakan untuk mengetahui apakah variabel independen secara bersama-sama (simultan) berpengaruh terhadap variabel dependen.

a. Berdasarkan hasil pengujian menggunakan aplikasi Eviews 10, diketahui bahwa nilai F hitung sebesar 7.094813 dengan signifikan 0.000109. Adapun nilai f_{tabel} didalam penelitian ini dihitung dengan df = 520-k-1 adalah sebesar 2,22 dengan signifikan 0.05. Maka dapat dilihat *Beta Cryptocurrency* (X1), Tingkat Suku Bunga (X2), Kurs Mata Uang (X3), Harga Minyak Dunia (X4), Harga Batu Bara (X5) dan Harga Emas Dunia (X6) berpengaruh positif dan signifikan secara simultan terhadap *Return Cryptocurrency* (Y). Hal tersebut ditunjukkan oleh hasil nilai thitung (7.094813) > t_{tabel} (2,22) dan nilai signifikan 0.000109 < 0.05. Sehingga dapat disimpulkan bahwa variabel *Beta Cryptocurrency* (X1), Tingkat Suku Bunga (X2), Kurs Mata Uang (X3), Harga Minyak Dunia (X4), Harga Batu Bara (X5) dan Harga Emas Dunia (X6) berpengaruh signifikan secara simultan terhadap *Return Cryptocurrency* (Y).

10. Hasil Uji Efek Moderating

Uji hipotesis dalam penelitian ini menggunakan *Moderated Regression Analysis* (MRA). MRA merupakan aplikasi khusus regresi berganda linier dimana dalam persamaan regresinya mengandung unsur interaksi (perkalian dua atau lebih variabel independen). MRA bertujuan untuk menguji hubungan antara variabel independen dan dependen yang dalam hubungan tersebut terdapat faktor yang memperkuat atau memperlemah (variabel moderasi).

a. Diketahui nilai koefisien MRA dari interaksi *Beta Cryptocurrency* (X1)_ Inflasi (Z) terhadap *Return Cryptocurrency* (Y) bernilai positif yaitu 4.039714

dengan T_{hitung} 4.039714 > 1.99254 dan nilai *p-value* 0,0000 < 0,05 hal ini menunjukkan variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara *Beta Cryptocurrency* (X1) dengan *Return Cryptocurrency* (Y).

b. Diketahui nilai koefisien MRA dari interaksi Tingkat Suku Bunga (X2)_ Inflasi (Z) terhadap *Return Cryptocurrency* (Y) bernilai positif yaitu 2.013933 dengan T_{hitung} 2.013933 > 1.99254 dan nilai *p-value* 0,0022 < 0,05 hal ini menunjukkan variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Tingkat Suku Bunga (X2) dengan *Return Cryptocurrency* (Y).
c. Diketahui nilai koefisien MRA dari interaksi Kurs Mata Uang (X3)_ Inflasi (Z) terhadap *Return Cryptocurrency* (Y) bernilai positif yaitu 1.746128 dengan T_{hitung} 1.746128 < 1.99254 dan nilai *p-value* 0,2225 > 0,05 hal ini menunjukkan variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Kurs Mata Uang (X3) dengan *Return Cryptocurrency* (Y).
d. Diketahui nilai koefisien MRA dari interaksi Harga Minyak Dunia (X4)_ Inflasi (Z) terhadap *Return Cryptocurrency* (Y) bernilai positif yaitu 0.636212 dengan T_{hitung} 0.636212 < 1.99254 dan nilai *p-value* 0,4166 > 0,05 hal ini menunjukkan variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Minyak Dunia (X4) dengan *Return Cryptocurrency* (Y).
e. Diketahui nilai koefisien MRA dari interaksi Harga Batu Bara (X5)_ Inflasi (Z) terhadap *Return Cryptocurrency* (Y) bernilai positif yaitu 0.641252 dengan T_{hitung} 0.641252 < 1.99254 dan nilai *p-value* 0,5011 > 0,05 hal ini menunjukkan variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Batu Bara (X5) dengan *Return Cryptocurrency* (Y).
f. Diketahui nilai koefisien MRA dari interaksi Harga Emas Dunia (X6)_ Inflasi (Z) terhadap *Return Cryptocurrency* (Y) bernilai positif yaitu 2.475163 dengan T_{hitung} 2.475163 > 1.99254 dan nilai *p-value* 0,0009 < 0,05 hal ini menunjukkan variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Emas Dunia (X6) dengan *Return Cryptocurrency* (Y).

11. Hasil Uji Joint Moderating Effect

Uji hipotesis dalam penelitian ini menggunakan *Moderated Regression Analysis* (MRA).

a. Diketahui nilai koefisien MRA dari interaksi *Beta Cryptocurrency* (X1)_ *Velocity of Cryptocurrency* (W) terhadap Inflasi (Z) bernilai positif yaitu 1.049393 dengan T_{hitung} 1.049393 < 1.99254 dan nilai *p-value* 0,6331 > 0,05 hal ini menunjukkan variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara *Beta Cryptocurrency* (X1) dengan *Return Cryptocurrency* (Y).
b. Diketahui nilai koefisien MRA dari interaksi Tingkat Suku Bunga (X2)_ *Velocity of Cryptocurrency* (W) terhadap Inflasi (Z) bernilai positif yaitu 2.039399 dengan T_{hitung} 2.039399 > 1.99254 dan nilai *p-value* 0,0025 < 0,05 hal ini menunjukkan variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Tingkat Suku Bunga (X2) dengan *Return Cryptocurrency* (Y).
c. Diketahui nilai koefisien MRA dari interaksi Kurs Mata Uang (X3)_ *Velocity of Cryptocurrency* (W) terhadap Inflasi (Z) bernilai positif yaitu 2.841293 dengan T_{hitung} 2.841293 > 1.99254 dan nilai *p-value* 0,0008 < 0,05 hal ini menunjukkan variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Kurs Mata Uang (X3) dengan *Return Cryptocurrency* (Y).
d. Diketahui nilai koefisien MRA dari interaksi Harga Minyak Dunia (X4)_ *Velocity of Cryptocurrency* (W) terhadap Inflasi (Z) bernilai positif yaitu 1.031893 dengan T_{hitung} 1.031893 < 1.99254 dan nilai *p-value* 0,4133 < 0,05 hal ini menunjukkan variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Minyak Dunia (X4) dengan *Return Cryptocurrency* (Y).
e. Diketahui nilai koefisien MRA dari interaksi Harga Batu Bara (X5)_ *Velocity of Cryptocurrency* (W) terhadap Inflasi (Z) bernilai positif yaitu 3.134636 dengan T_{hitung} 3.134636 > 1.99254 dan nilai *p-value* 0,0000 < 0,05 hal ini menunjukkan variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Batu Bara (X5) dengan

Return Cryptocurrency (Y).

f. Diketahui nilai koefisien MRA dari interaksi Harga Emas Dunia (X6)_ *Velocity of Cryptocurrency* (W) terhadap Inflasi (Z) bernilai positif yaitu 1.484346 dengan T_{hitung} 1.484346 < 1.99254 dan nilai *p-value* 0,4184 > 0,05 hal ini menunjukkan variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Emas Dunia (X6) dengan *Return Cryptocurrency* (Y).

4.2 Pembahasan

Hasil dari uji kausalitas menunjukkan bahwa hipotesis yang pertama "Diduga terdapat hubungan kausalitas antara variabel *Beta Cryptocurrency*, Tingkat Suku Bunga, Tingkat Suku Bunga, Harga Minyak Dunia, Harga Batu Bara, Harga Emas Dunia terhadap *Return Cryptocurrency* dapat diterima, hal ini dapat dilihat dalam hasil uji kausalitas dengan melihat nilai probabilitas yang menunjukkan harga batu bara dan tembaga memiliki hubungan kausalitas satu arah terhadap indeks harga saham sektor pertambangan karena nilai probabilitas lebih kecil dari 5%. Ini berarti perubahan variabel harga batu bara, minyak mentah dan tembaga mempengaruhi perubahan indeks harga saham sektor pertambangan. Namun harga timah, emas, nikel, lebih besar dari 5%, sehingga dapat disimpulkan bahwa harga komoditas timah, emas, nikel tidak terdapat hubungan kausalitas terhadap indeks harga saham sektor pertambangan.

Hasil dari Uji IRF menunjukkan bahwa hipotesis yang keempat "Diduga terdapat respons antara variabel indeks harga saham sektor pertambangan terhadap guncangan variabel harga batu bara, timah, emas, nikel, tembaga dan minyak mentah dunia." dapat diterima, hal ini dapat dilihat dalam hasil variabel indeks harga saham sektor pertambangan memberikan respons perubahan pada guncangan yang diberikan oleh variabel harga minyak mentah, harga tembaga, harga emas, harga batubara, harga timah dan harga nikel dunia, dengan adanya respons tersebut dapat menjadi acuan dalam penentuan investasi pada sektor pertambangan yang memberikan respons dalam 60 periode penelitian. Berdasarkan uji FEVD menunjukkan bahwa hipotesis yang kelima " Diduga terdapat kontribusi variabel harga batu bara, timah, emas, nikel, tembaga dan

minyak mentah dunia terhadap Indeks Harga Saham sektor pertambangan" dapat diterima. Hal ini dibuktikan dengan hasil uji menunjukkan variabel harga minyak mentah, harga tembaga, harga emas, harga batubara, harga timah dan harga nikel dunia memberikan kontribusi pada perubahan indeks harga saham sektor pertambangan yang diakibatkan guncangan variabel lain di luar variabel penelitian. Dengan adanya kontribusi dari variabel harga komoditas terhadap sektor pertambangan ini dapat dijadikan sebagai acuan bagi para investor apabila ingin menginvestasikan dananya dalam indeks saham khususnya sektor pertambangan

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Berdasarkan hasil analisis data dan pembahasan yang telah dilakukan pada bab sebelumnya, maka peneliti mengambil beberapa kesimpulan sebagai berikut:

1. Dapat disimpulkan bahwa variabel *Beta Cryptocurrency* (X1) berpengaruh positif dan signifikan terhadap *Return Cryptocurrency* (Y).
2. Dapat disimpulkan bahwa variabel Tingkat Suku Bunga (X2) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y).
3. Dapat disimpulkan bahwa variabel Kurs Mata Uang (X3) berpengaruh signifikan terhadap *Return Cryptocurrency* (Y).
4. Dapat disimpulkan bahwa variabel Harga Minyak Dunia (X4) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y).
5. Dapat disimpulkan bahwa variabel Harga Batu Bara (X5) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y).
6. Dapat disimpulkan bahwa variabel Harga Emas Dunia (X6) berpengaruh signifikan terhadap *Return Cryptocurrency* (Y).
7. Dapat disimpulkan bahwa variabel Inflasi (Z) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y).
8. Dapat disimpulkan bahwa variabel *Velocity of Cryptocurrency* (W) berpengaruh tidak signifikan terhadap *Return Cryptocurrency* (Y).
9. Dapat disimpulkan bahwa variabel *Beta Cryptocurrency* (X1), Tingkat Suku Bunga (X2), Kurs Mata Uang (X3), Harga Minyak Dunia (X4), Harga Batu Bara (X5) dan Harga Emas Dunia (X6) berpengaruh signifikan secara simultan terhadap *Return Cryptocurrency* (Y).
10. Variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara *Beta Cryptocurrency* (X1) dengan *Return Cryptocurrency* (Y).
11. Variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Tingkat Suku Bunga (X2) dengan *Return Cryptocurrency* (Y).

12. Variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Kurs Mata Uang (X3) dengan *Return Cryptocurrency* (Y).
13. Variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Minyak Dunia (X4) dengan *Return Cryptocurrency* (Y).
14. Variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Batu Bara (X5) dengan *Return Cryptocurrency* (Y).
15. Variabel Inflasi (Z) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Emas Dunia (X6) dengan *Return Cryptocurrency* (Y).
16. Variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara *Beta Cryptocurrency* (X1) dengan *Return Cryptocurrency* (Y).
17. Variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Tingkat Suku Bunga (X2) dengan *Return Cryptocurrency* (Y).
18. Variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Kurs Mata Uang (X3) dengan *Return Cryptocurrency* (Y).
19. Variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Minyak Dunia (X4) dengan *Return Cryptocurrency* (Y).
20. Variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Batu Bara (X5) dengan *Return Cryptocurrency* (Y).
21. Variabel *Velocity of Cryptocurrency* (W) merupakan variabel moderator yang mempengaruhi hubungan antara Harga Emas Dunia (X6) dengan *Return Cryptocurrency* (Y).

DAFTAR PUSTAKA

Apsara, R. H., & Indriani, A. 2017. Analisis Pengaruh Crude Oil Price, Earning Per Share, Price To Book Value, Return On Assets Dan Debt To Equity Ratio Terhadap Harga Saham Perusahaan Batubara Yang Terdaftar Di Bursa Efek Indonesia Periode (2012-2016). *Diponegoro Journal Of Management*, *6*(4), 1–13.

Asmar, M., Ahmad, Z. 2011. Market microstructure: The components of black-box. International Journal of Economics and Finance, Vol. 3(1).

Ayem, Sri. 2016. Pengaruh Profitabilitas, Struktur Modal, Kebijakan Deviden, dan Keputusan Investasi Terhadap Nilai Perusahaan. Jurnal Akuntansi Vol. 4(1).

Falkner, E. M., & Hiebl, M. R. 2015. Risk Management in SMEs: A Systematic Review of Available Evidence. *The Journal of Risk Finance*, Vol. 16(22).

Ho, C., & Hung, C. (2009). Investor sentiment as conditioning information in asset pricing. *Journal of Banking & Finance*, 33(5), 892-903.

Ilham, R. N., Erlina, Fachrudin, K. A., Silalahi, A.S., Saputra, J., Albr, W., 2019. Investigation of the Bitcoin Effects on the Country Revenues via Virtual Tax Transactions for Purchasing Management. International Journal of Supply Chain Management. Vol. 8(6).

Ilham, R. N., Erlina, Fachrudin, K. A., Silalahi, A.S., Saputra, J. 2019. Comparative of the Supply Chain and Block Chains to Increase the Country Revenues via Virtual Tax Transactions and Replacing Future of Money. International Journal of Supply Chain Management. Vol. 8(5).

Ilham, R. N., Fachrudin, K. A., Pakpahan, E. E. 2019. The Challenge in Application of Cryptocurrency as Commodity in Indonesia. International Conference on Finance, Economics and Business.

Ilham, R. N., Sadalia, I., Irawati, N., Sinta, Irada. 2022. Al Qalam: Jurnal Ilmiah Keagamaan dan Kemasyarakatan. Vol. 16(1).

Kaluge, D. (2019). Multifactor On Macroeconomic Fundamentals To Explain The Behavior Of Sectoral Indices In The Indonesian Stock Exchange. *Entrepreneurship And Sustainability Issues*.

Komalasari, Y. T. (2019). Analisis Pergerakan Indeks Saham Sektor Pertambangan Di Bursa Efek Indonesia. *Jurnal Bisnis Dan Manajemen (Jbima)*, *7*(1), 1–17.

Koskei, L. 2017. The Effect of Exchange Rate Risk on Stock Returns in Kenya's Listed Financial Institutions. *Research Journal of Finance and Accounting*. Vol. 8(3).

Liu, Y., & Tsyvinski, A. 2018. Risks and Returns of *Cryptocurrency*. *SSRN Electronic Journal*.

Lento, G. L. D., Latif, I. N., & Verahastuti, C. 2019. Analisis Portofolio Saham Pada Perusahaan Sub Sektor Pertambangan Yang Terdaftar Di Bursa Efek Indonesia (Bei) Dengan Pendekatan Capital Asset Pricing Model (Capm) Dan Arbitrage Pricing Theory (Apt). *Journal Of Indonesian Science Economic Research*, *1*(2), 12–19.

Malla, N., & Asianto, A. 2020. The Determinant Of Mining Sector Stock Price Index At Indonesia Stock Exchange. *International Journal Of Academic*

Research In Accounting, Finance And Management Sciences. Vol. 10-13, 7678.

Mankiw, N, Gregory, 2003, Macroeconomics, *Worth Publishers*: 271.

Penman, S., & Reggiani, F. 2013. Returns to buying earnings and book value: Accounting for growth and risk. *Review of Accounting Studies*, Vol. 18(4).

Putra, R. D., et al. 2013. Analisis Pemilihan Investasi Saham dengan Menggunakan Metode Capital Asset Pricing Model (CAPM) dan Reward to Variability Ratio (RVAR) sebagai Penentu Pengambilan Keputusan Investasi Saham.Jurnal Administrasi Bisnis. Vol. 1(2).

Sadalia, I., Irawati, N., Ilham, R. N., Hasibuan, A. N., Sirait, R. T. M., Saragih, M. M. S. 2021. Cryptocurrency Return Assessment Model Based on Negative Risk Factors And Determinant Effect By Velocity of Cryptocurrency Pattern: an Empirical Objective Report from Indonesia Cryptocurrency Exchange. The International Journal of Accounting.

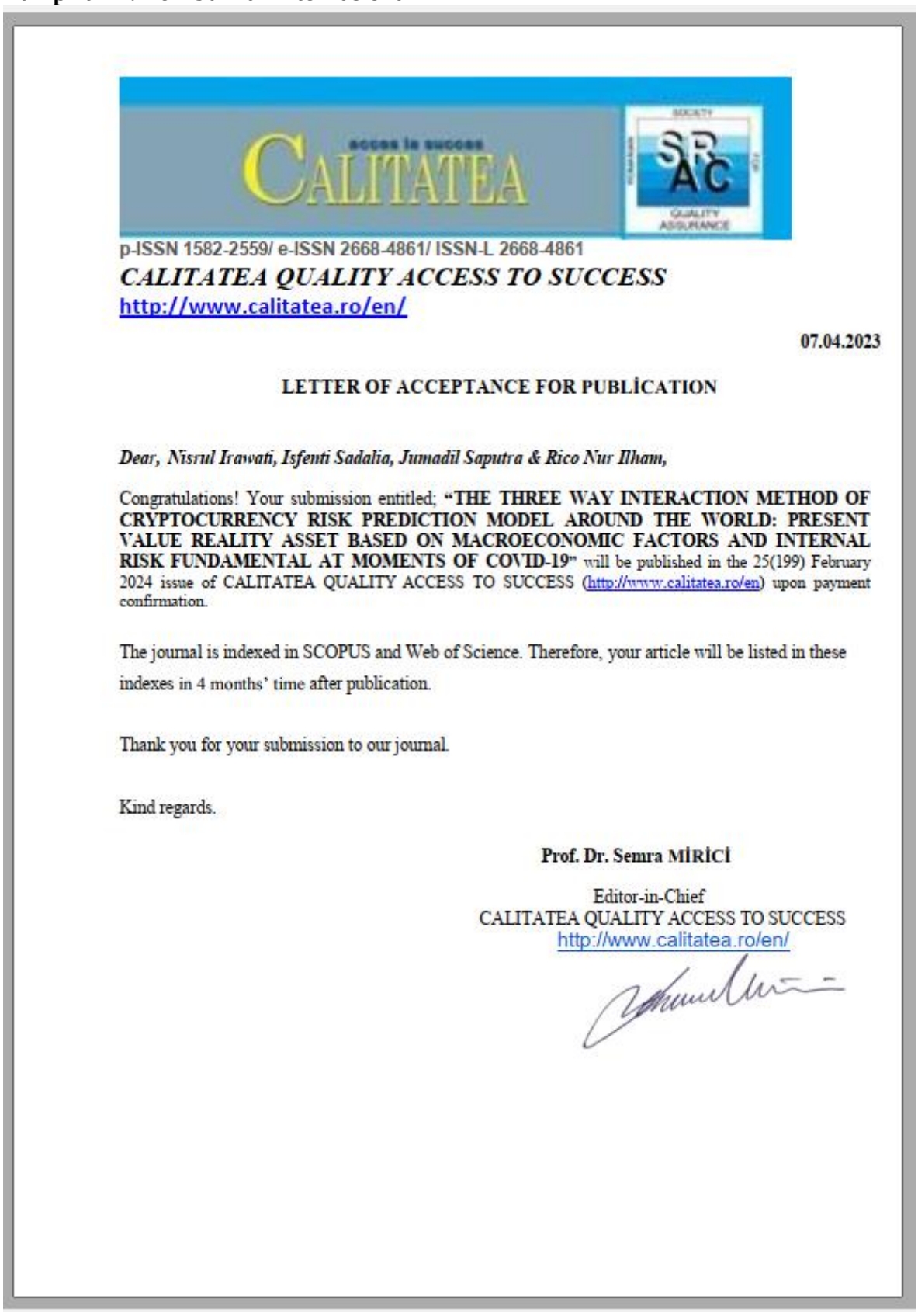
Sadalia, I., Irawati, N., Ilham, R. N., Hasibuan, A. N., Sinurat, M., Saharudin. 2021. Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On Cryptocurrency In Indonesia. The International Conference on Business and Management of Technology. Vol. 202.

Siringoringo, Renniwaty. 2017. Analisis Fungsi Intermediasi Perbankan Indonesia (Studi Kasus Bank Umum Konvensional yang Tercatat di BEI Periode 2012-2016). Jurnal Inspirasi Bisnis dan Manajemen. Vol. 1 (2).

Yohanes, Agustinus. 2009. Pengukuran Interaksi Agen dan Efeknya terhadap Volatilitas Perdagangan Saham di Bursa Efek Indonesia.

LAMPIRAN

Lampiran 1. LoA Jurnal Internasional



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LETTER OF ACCEPTANCE FOR PUBLİCATION

Dear, Nisrul Irawati, Isfenti Sadalia, Jumadil Saputra & Rico Nur Ilham,

Congratulations! Your submission entitled; **"THE THREE WAY INTERACTION METHOD OF CRYPTOCURRENCY RISK PREDICTION MODEL AROUND THE WORLD: PRESENT VALUE REALITY ASSET BASED ON MACROECONOMIC FACTORS AND INTERNAL RISK FUNDAMENTAL AT MOMENTS OF COVID-19"** will be published in the 25(199) February 2024 issue of CALITATEA QUALITY ACCESS TO SUCCESS (http://www.calitatea.ro/en) upon payment confirmation.

The journal is indexed in SCOPUS and Web of Science. Therefore, your article will be listed in these indexes in 4 months' time after publication.

Thank you for your submission to our journal.

Kind regards.

Prof. Dr. Semra MİRİCİ

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Lampiran 2. Jurnal Internasional

THE THREE WAY INTERACTION METHOD OF CRYPTOCURRENCY RISK PREDICTION MODEL AROUND THE WORLD: PRESENT VALUE REALITY ASSET BASED ON MACROECONOMIC FACTORS AND INTERNAL RISK FUNDAMENTAL AT MOMENTS OF COVID-19

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Abstract

Investments in digital assets or cryptocurrencies are increasingly widespread around the world, including in Indonesia.Decisions in choosing investment instruments can be made by buying company shares on the Indonesia Stock Exchange and cryptocurrency sales markets. The expected profit is the return expected to be obtained by investors in the future. The resulting novelty is in the form of a new concept in investment called the velocity of cryptocurrency, this variable has never been studied in the concept of investment management and in the future it is hoped that more parties will develop research on the rate of circulation and movement of cryptocurrency digital assets, then valuation models and predictions of asset prices. digital cryptocurrency based on fundamental risk factors and fluctuations in world commodity prices called the cryptocurrency risk prediction model, and legal cryptocurrency and tax revenue which is formulated by carrying out focus group discussions on tax collection policies on buying and selling transactions of cryptocurrency digital assets. The population of this study is 10 (ten) cryptocurrency coins with the largest market caps in the world. The type of data in this study is pooled data taken in 1 year from January to December 2021, coinciding with the moment of the COVID-19 pandemic by taking transaction report data. cryptocurrency weekly so that a target population of 520

observations (52 weeks x 10 coins) is obtained for 1 year. Weekly transaction report data which is a sample of 520 data in this study. Data analysis in this study was to analyze what factors influence Return on Cryptocurrency with the stages of descriptive statistics, data stationarity test, classic assumption test, moderating hypothesis, threeway interaction regression model and joint moderating effects regression analysis, research hypothesis test. This research is an international collaborative research that refers to the Sustainable Development Goals with the aim of strengthening an inclusive society for sustainable development at all levels. The targeted outputs are publications of reputable international journals at the ABAC Journal Assumption University (Q1), Turkish Journal of Physiotherapy and Rehabilitation (Q4), and indexed international proceedings at the Global Conference on Business, Management and Entrepreneurship. data stationarity test, classic assumption test, moderating hypothesis, three-way interaction regression model and joint moderating effects regression analysis, research hypothesis test. This research is an international collaborative research that refers to the Sustainable Development Goals with the aim of strengthening an inclusive society for sustainable development at all levels. The targeted outputs are publications of reputable international journals at the ABAC Journal Assumption University (Q1), Turkish Journal of Physiotherapy and Rehabilitation (Q4), and indexed international proceedings at the Global Conference on Business, Management and Entrepreneurship. data stationarity test, classic assumption test, moderating hypothesis, three-way interaction regression model and joint moderating effects regression analysis, research hypothesis test. This research is an international collaborative research that refers to the Sustainable Development Goals with the aim of strengthening an inclusive society for sustainable development at all levels. The targeted outputs are publications of reputable international journals at the ABAC Journal Assumption University (Q1), Turkish Journal of Physiotherapy and Rehabilitation (Q4), and indexed international proceedings at the Global Conference on Business, Management and Entrepreneurship. This research is an international collaborative research that refers to the Sustainable Development Goals with the aim of strengthening an inclusive society for sustainable development at all levels. The targeted outputs are publications of reputable international journals at the ABAC Journal Assumption University (Q1), Turkish Journal of Physiotherapy and Rehabilitation (Q4), and indexed international proceedings at the Global Conference on Business, Management and Entrepreneurship. This research is an international collaborative research that refers to the Sustainable Development Goals with the aim of strengthening an inclusive society for sustainable development at all levels. The targeted outputs are publications of reputable international journals at the ABAC Journal Assumption University (Q1), Turkish Journal of Physiotherapy and Rehabilitation (Q4), and indexed international proceedings at the Global Conference on Business, Management and Entrepreneurship.

Keywords: cryptocurrencies; world commodity prices; internal risk fundamental factors, macroeconomics

1. Formulation of the problem

Investment is an investment directly or indirectly, as well as short term or long term with the aim of obtaining the expected profit or other forms of benefits from the results of the investment itself. Starting from the investment there is a desired profit (return). This can be seen from the representation of the blockchain whose impact can be enjoyed directly by the public

(consumers), and there are many other potentials that can be explored, so that interest in cryptocurrencies, generally as investment instruments, actually only increased sharply after the Bitcoin exchange rate experienced a surge. high enough. Bitcoin cryptocurrency is produced through data encryption and certain algorithms.

The mining industry supports the Indonesian economy in that revenue from sales taxes and royalties can be allocated to support economic development (Apsara & Indriani, 2017). Indonesia is also one of the countries with very high mineral reserve potential which is in the 24th position as the largest exporting country in the world with the largest exports of mining commodity commodities in Indonesia being dominated by coal, tin, copper and gold. The shares of companies in the mining sub-sector tend to fluctuate (Kaluge, 2019; Lento, Latif, & Verahastuti, 2019; Malla & Asianto, 2020).

Digital currency (cryptocurrency) has become a global phenomenon that most people are familiar with. While most people, banks, governments and many other companies are not aware of the importance of cryptocurrencies. The level of cryptocurrency development from year to year is considered quite significant. The development of one type of cryptocurrency that has the greatest value today, namely bitcoin, is not only rife in foreign countries. With the contribution of commodity prices in the mining sector, this can be used as a reference for investors if they want to invest their funds in stock indexes, especially at world commodity prices.

Table 1
Cryptocurrency Transactions and Market Capitalitation

Cryptocurrencies	**Market Cap (USD) December 31, 2020**	**Market Cap (BTC) December 31, 2020**
Ethereum	83.693.010.16243	2.925.612.939971
Bitcoins	531,650,756,634,144	18,586,500,000001

Source: BTC live CoinMarketCap 2021

It can be seen that the market capitalization of several cryptocurrencies is quite large in value, illustrating that investment in cryptocurrency digital asset instruments has quite a large profit opportunity, but must be accompanied by risk control. One of the most important parts of studying investing is how to measure risk and return. The definitions of risk and return will never be the same between one investor and another, even the level of preference for risk and return will never be the same (Liu & Tsyvinski, 2018). Every investor who wants to maximize wealth will be attracted to an investment that provides a higher level of expected return compared to other investment opportunities. The expected profit (expected return) is the return expected to be obtained by investors in the future. Based on the fact that almost all investments contain uncertainty or risk (Koskei, 2017).

The entry of foreign investors in mining stocks also encourages local investors to buy these shares which will cause an increase in mining stock prices (Komalasari, 2019). The purpose of the research is in the form of a documentation study intended in this research is to find secondary data. Therefore, following the specifications of the research scheme, in accordance with USU's Strategic Plan which focuses on TALENTA which is based on local wisdom by providing empirical evidence about the influence of macroeconomic factors that will have an impact, both in the form of profits and losses for investors in the crypto digital asset transaction process.

1.6 Formulation of the problem

Based on the background of the problems that have been described, the formulation of the problem in this study is:

4. Does the risk factor and word commodity price have an influence on cryptocurrency returns?
5. Does the risk factor and word commodity price have an influence on cryptocurrency returns with inflation as a moderation?
6. Do the risk factors and word commodity prices have an influence on cryptocurrency returns with inflation as a moderator and the velocity of cryptocurrency as a joint moderating effect?

2. MATERIALS AND METHODS

2.1 *Market Microstructure Theory*

The role of the microstructure in this case is to assemble mechanisms that are not only an impact on prices, but also what happens in the market as an object of meeting of economic agents, which may be that the market itself has also become a trade intermediary entity or can be viewed as a platform for transactions to occur. (Pratiwi, 2018). Asmar, & Ahmad, (2011) define market

microstructure as the study of trade mechanisms and regulations used to achieve trade. Interaction between agents is also a topic in market microstructure and for Indonesia (John, 2009). Each agent has a strategy for conducting transactions where fundamental uses the opportunity cost approach of share ownership and technical analysis uses a technical analysis approach.

2.2 *Signaling Theory*

*signaling theory*is an effect arising from the announcement of financial statements captured by users of financial statements (especially investors). Signaling theory states that companies that are able to generate profits tend to increase their debt because the additional interest paid will be offset by profit before tax (Ayem, 2016). Signaling effects are generated by new information, and not by issues that occur (Penman, & Reggiani, 2013). Thus, a company with highly profitable prospects would avoid selling stock, and instead raise the new capital needed by using new debt even though this would be a debt ratio above the target level.

2.3 *Capital Asset Pricing Model*

The most important thing that needs to be done by an investor is to have the ability to estimate the return of a security (Putra, et al. 2013). Therefore, there is a model that can be used to estimate the return of a security stock, namely the Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model (CAPM) is a model or method for estimating the return value of an asset by comparing the variable return received and the risk borne.

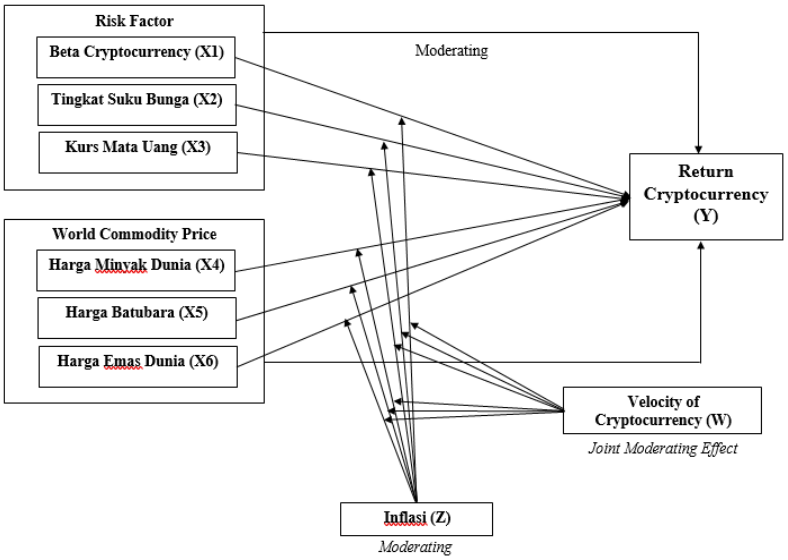
2.4 *Risk Management*

Risk management becomes more important in the financial sector compared to other economic sectors (Falkner, & Hiebl, 2015). Mankiw (2003) explains that the currency exchange rate between two countries is the price of the currency used by residents of these countries to trade with each other. Ho and Hung (2009) also use conditional beta on investor sentiment, default spread and stock characteristics and then find that investment sentiment also helps to better capture the impact of anomalies in stock price models. We will also be implementing a conditional beta that depends on the uncertainty, cryptocurrency characteristics, and Bitcoin returns.

2.5 *Economic Theory Of Regulation*

Banking regulations in Indonesia are generally implemented in Bank Indonesia regulations through circular letters which are always updated or amended according to the conditions and situation of the national banking system. According to Siringoringo (2017) as a developer of the economic theory of regulation, regulation is an act of suppressing groups that produce laws and policies to support businesses and protect consumers, workers and the environment.

2.6 Research Framework



2.7 Types of research

This type of research is descriptive quantitative and explanatory research, namely research that explains the causal relationship, cause and effect between the independent variables and the dependent variable.

2.8 Population and Sample

The population of this study are the ten Cryptocurrency coins with the largest market caps in Indonesia, namely Bitcoin (BTH), Ethereum (ETH), Ripple (XRP), Bitcoin Cash (BCH), Litecoin (LTC), Stellar, DASH, Dogecoin, Zcash, Monero. in Indonesia. The type of data in this study is Pooled Data (Data Panel) taken from January 2020-December 2021 to coincide with the Covid-19 pandemic moment by conducting a documentary study conducted on the publication of cryptocurrency weekly transaction reports so that a target population of 520x1 year is obtained, where observations weekly transaction report data which is a data sample of 520 weeks in 2020 and 2021.

2.9 Collection technique

Primary and secondary data collection techniques in this study are Documentation Studies in the form of cryptocurrency return data, cryptocurrency beta, interest rates, currency exchange rates, world oil prices, coal prices, world gold prices, inflation and velocity of cryptocurrency obtained from Blockchain.info and other online exchanges. The data used in this study is weekly transaction data starting from January to December 2020 during the Covid-19 pandemic. One of the main sites in collecting data in this study iswww.indodax.comandwww.coin-geco.comwhich provides direct cryptocurrency exchange services.

This study uses an explanatory case study method to explain the influence of the variables used in this study through testing the established research hypotheses. While the technique used is Pooled Data.

1. Data analysis technique

Quantitative data analysis in this study is to analyze what factors affect returns on cryptocurrency. Before making conclusions in a research analysis of the data must be done so that the research results are accurate. So this research was conducted using statistical methods assisted by the E-VIEWS 10 program. The analysis in this study used panel data which is a combination of time-series data and cross-sectional data.

The following is the regression equation of the Multiple Regression Analysis Panel Model that will be used in this study as follows:

Equation: Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7Z + b8W+ ei

The following is the regression equation of the Three way Interaction Model and Joint Moderating Effects Regression Analysis which will be used in this study are as follows:

Equation: Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7Z + b8W + b9X1Z + b9X2.*Z + b10X3*Z + b11X4*Z + b12X5*Z + b13X6*Z + b14X1*W + b15X2 *W + b16X3*W + b17X4*W + b18X5*W + b19X6*W + b20Z*W + b21X1Z*W + b22X2.Z*W + b23X3Z*W + b24X4Z*W + b25X5Z*W + b26X6Z*W + ei

3. RESULTS AND DISCUSSION

a. Results of Data Analysis

To see how to get a good model in panel data regression analysis, a model selection technique is needed. This research uses panel data regression analysis technique, which is a combination of time-series data and cross-section data. Panel data regression consists of 3 models, namely the Common Effect Model (CEM), Fixed Effect Model (FEM) and Random Effect Model (REM). The results of testing the three models in this research are as follows:

Table 3.1
Results of Panel Data Testing of the Three Models

variabel	Common Effect Model (CEM)		Fixed Effect Model (FEM)		Random Effect Model (REM)	
	koefisien	Sig	koefisien	Sig	koefisien	Sig
C	23.41343	0.000	20.13412	0.022	19.03828	0.011
Beta Cryptocurrency (X1)	2.121424	0.005	1.652355	0.008	1.049001	0.013
Tingkat Suku Bunga (X2)	2.343441	0.012	2.241345	0.011	3.091883	0.035
Kurs Mata Uang (X3)	1.525222	0.031	2.121244	0.021	1.009381	0.046
Harga Minyak Dunia (X4)	1.024583	0.000	1.521435	0.004	2.262800	0.053
Harga Batu Bara (X5)	5.049237	0.011	2.004544	0.022	1.412722	0.028
Harga Emas Dunia (X6)	1.903856	0.023	2.041222	0.019	1.462721	0.059
Inflasi (Z)	3.120529	0.033	3.162464	0.027	2.946272	0.069
Velocity of *Cryptocurrency* (W)	1.542386	0.009	2.142356	0.008	1.093877	0.058

Based on the table above, it can be seen that all the coefficient and significance values for the panel data regression model are based on the Common Effect Model (CEM), Fixed Effect Model (FEM) and Random Effect Model (REM) in this study.

b. Chow test

Table 3.2
Chow Test Results

Effects Test	Statistic	d.f.	Prob.
Cross-section F	8.841248	(65,190)	0.0000
Cross-section Chi-square	211.842741	520	0.0007

Based on the chow test table, it shows that the probability value on the chow test is 0.0007. This value is below the standard error tolerance value in this study, which is 0.05. Therefore, based on the results of the Chow test, the best model in this study is the Fixed Effect Model (FEM).

c. Hausman test

Table 3.3
Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.263449	6	0.9879

Based on the Hausman test table above,it can be seen that the probability value on the Hausman test is 0.9879. This value is above the standard error tolerance value in this study, which is 0.05. Therefore, the best panel data regression model in this study is the Random Effect Model (REM).

d. Data Normality Test

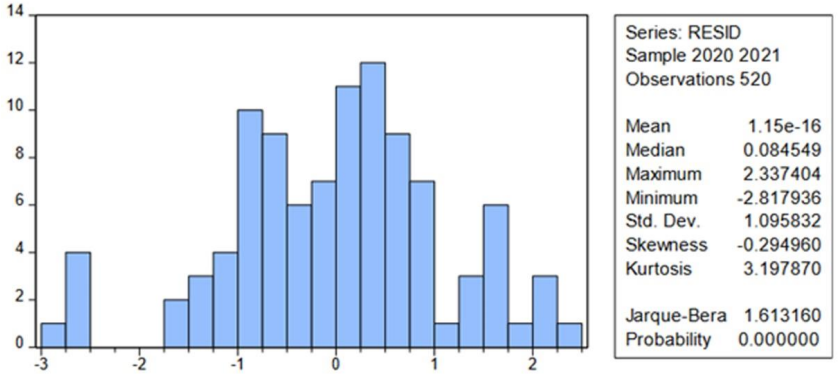


Figure 4.1
Normality Chart

Based on the picture above, it can be seen that the Jarque-Bera test value is 1.613160 and the Probability value is 0.000000 where this value is below the standard error tolerance value (5%). Therefore, it can be concluded that the residuals are normally distributed.

e. The heteroscedasticity Test

Table 3.4
Heteroscedasticity Test Results

Dependent Variable: RESABS
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variables	coefficient	std. Error	t-Statistics	Prob.
C	18.01248	11.31422	3.143555	0.0000
BETA_CRYPTOCURRENCY_X1	2.028424	0.312424	1.039593	0.1523
LEVELS_TLEAN_FLOWER_X2	1.135013	2.604393	1.131153	0.0863
KURS_EYE_UANG_X3	2.413424	3.053531	3.004124	0.127
PRICE_OIL_DUNIA_X4	1.013842	0.11412	0.114401	0.242
PRICE_BATU_BARA_X5	-3.013492	2.256335	0.412442	0.4342
PRICE_GOLD_DUNIA_X6	2.023533	3.513534	-3.01349	0.0898
INFLATION_Z	-1.41222	1.535333	-1.14552	0.1526
VELOCITY_OF_CRYPTOCURRENCY_W	2.410422	4.246332	1.110533	0.6462

Effects Specification

	SD	Rho
Random cross-sections	13.13745	0.1577
Idiosyncratic random	20.53001	0.6043

Based on the table above, it can be seen that all independent variables in the Glajser test are above 0.05.

f. Multicollinearity Test

Table 3.5
Multicollinearity Test Result

	R_C_Y	B_C_X1	T_S_B_X2	K_M_U_X3	H_M_D_X4	H_B_B_X5	H_E_D_X6	I_Z	V_C_W
R_C_Y	1000000	-0.241233	-0.120152	0.7235733	-1.021385	0.352385	0.736433	-0.05931	0.513444
B_C_X1	-0.084744	1000000	0.4000	0.517533	-0.12414	0.523255	-0.52303	-1.23039	0.134144
T_S_B_X2	-0.03844	0.4626525	1000000	0.53153	0.62541	-1.737422	0.424242	0.64514	0.64262
K_M_U_X3	0.013843	0.654122	0.4612742	1000000	0.745113	0.427424	0.72565	0.13133	-1.09913
H_M_D_X4	0.736111	0.152422	0.17424	0.515313	1000000	0.64124	0.6414	0.431545	0.417145
H_B_B_X5	0.413422	-0.01284	-0.74262	-0.625412	-0.51531	1000000	-0.64182	-1.02194	-0.12351
H_E_D_X6	0.26244	-	0.64272	-1.01983	-0.35533	0.432164	1000000	0.46212	-0.4124

	4	1.73643				1			
I_Z	0.62462	0.017343	-0.42722	0.51433	0.761535	-0.74272	-0.64264	1000000	-.412461
V_C_W	-1.081373	0.412742	-1.427422	0.561813	0.51435	-0.426414	-1.42642	0.11091	1000000

Shows that this model does not have multicollinearity symptoms by looking at the output between the independent variables in the regression, there is no output that exceeds 0.8.

g. Autocorrelation Test

Table 3.6
Autocorrelation Test Results

R-squared	0.084133	Mean dependent var	8.412424
Adjusted R-squared	3.013422	SD dependent var	10.24124
SE of regression	13.39393	Sum squared residue	427436.2
F-statistics	9.124012	Durbin-Watson stat	1.925172
Prob(F-statistic)	0.004235		

The autocorrelation test can be seen from the Durbin Watson value in this study. The value of Durbin Watson in this study is1. 925172and the number of samples is 520 (n), the number of independent variables is 6 (k = 2), then the value of Durbin-Watson, DW1. 925172greater than the upper limit (du) 1.8000 and less (dl) 1.4029, with a table value at a significance level of 5%, it can be concluded that there is no autocorrelation in this regression model, or the calculation can be concluded that the DW value lies in test area. with an upper limit value (du) 1.8000 and a lower limit (dl) 1.4029.

h. Multiple Linear Regression Models

Table 3.7
Multiple Linear Regression Model Results

Dependent Variable: Return_Cryptocurrency_Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variables	coefficient	std. Error	t-Statistics	Prob.
C	22.42241	8.312424	6.143555	0.0000
BETA_CRYPTOCURRENCY_X1	1.535215	0.039595	2.634642	0.0053
LEVELS_TLEAN_FLOWER_X2	2.941466	2.413356	1.903953	0.0011
KURS_EYE_UANG_X3	3.348686	4.029455	3.385232	0.0102
PRICE_OIL_DUNIA_X4	1.617557	0.058236	0.745233	0.5303
PRICE_BATU_BARA_X5	-2.72457	2.241395	-1.52763	0.3722
PRICE_GOLD_DUNIA_X6	3.892556	4.620494	2.098527	0.0032
INFLATION_Z	-1.61713	2.254123	-1.41234	0.2505
VELOCITY_OF_CRYPTOCURRENCY_W	3.127722	6.105992	1.005224	0.3124
BETA_CRYPTOCURRENCY_X1_INFLATION_Z	2.343741	0.632781	4.039714	0.0000
LEVEL_SUKU_INFLATION_X2_INFLATION_Z	0.917378	1.423019	2.013933	0.0022
KURS_EYE_UANG_X3_INFLASI_Z	0.901333	1.241555	1.746128	0.2225
PRICE_OIL_DUNIA_X4_ INFLATION_Z	1.514427	2.031831	0.636212	0.4166
PRICE_BATU_BARA_X5_ INFLATION_Z	2.762621	0.830392	0.641252	0.5011
PRICE_GOLD_DUNIA_X6_ INFLATION_Z	3.123381	1.531617	2.475163	0.0009
BETA_CRYPTOCURRENCY_X1_	4.738733	1.028284	2.021384	0.0034

VELOCITY_OF_CRYPTOCURRENCY_W				
LEVEL_SUKU_BUNGA_X2_VELOCITY_OF_CRYPTOCURRENCY_W _Z	2.251281	1.412627	3.042948	0.0000
KURS_EYE_UANG_X3_VELOCITY_OF_CRYPTOCURRENCY_W	1.123474	2.029481	2.472825	0.0014
PRICE_OIL_DUNIA_X4_VELOCITY_OF_CRYPTOCURRENCY_W	1.748211	0.626261	0.726421	0.4255
PRICE_BARU_BAR_X5_VELOCITY_OF_CRYPTOCURRENCY_W	0.124216	2.048272	3.402842	0.0000
PRICE_GOLD_DUNIA_X6_VELOCITY_OF_CRYPTOCURRENCY_W	0.867223	1.042811	1.764272	0.2498
BETA_CRYPTOCURRENCY_X1_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	2.981939	2.041384	1.049393	0.6331
LEVEL_SUKU_BUNGA_X2_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	2.212164	1.014384	2.039399	0.0025
KURS_CURRENCY_UANG_X3_INFLASI_Z_VELOCITY_OF_CRYPTOCURRENCY_W	1.271938	0.351723	2.841293	0.0008
PRICE_OIL_DUNIA_X4_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	0.261421	2.417390	1.031893	0.4133
PRICE_BATU_BAR_X5_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	2.421330	1.043938	3.134636	0.0000
PRICE_GOLD_DUNIA_X6_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	1.182877	1.041381	1.484346	0.4184

R-squared	0.641242	Mean dependent var	8.413422
Adjusted R-squared	0.590921	SD dependent var	11.424222
SE of regression	17.042922	Sum squared residue	4.192829
F-statistics	7.094813	Durbin-Watson stat	3.004728
Prob(F-statistic)	0.000109		

Unweighted Statistics

R-squared	0.415362	Mean dependent var	14.09383
Sum squared residue	141523.55	Durbin-Watson stat	2.732853

Based on the table above, the regression equation models that can be compiled in this study are as follows:

Return Cryptocurrency = 22.42241 + 1.535215 Beta Cryptocurrency (X1) + 2.941466 Interest Rates (X2) + 1.617557 Currency Exchange (X3) + 1.617557 World Oil Prices (X4) – 2.72457 Coal Prices (X5) + 3.892556 World Gold Prices (X6) -1.61713 Inflation (Z) + 3.127722 Velocity of Cryptocurrency (W) + 2.343741 Beta Cryptocurrency (X1)_ Inflation (Z) + 0.917378 Interest Rate (X2)_Inflation (Z) +

0.901333 Currency Exchange (X3)_ Inflation (Z) + 1.514427 World Oil Prices (X4)_Inflation (Z) + 2.762621 Coal Prices (X5)_Inflation (Z) + 3.123381 World Gold Prices (X6)_Inflation (Z) + 4.738733 Beta Cryptocurrency X1_ Velocity of Cryptocurrency (W) + 2.251281 Interest Rates (X2)_Velocity of Cryptocurrency (W) + 1.123474 Currency Exchange Rates (X3)_ Velocity of Cryptocurrency (W) + 1.748211 World Oil Prices (X4)_ Velocity of Cryptocurrency (W) + 0.124216 Coal Price (X5)_ Velocity of Cryptocurrency (W) + 0.867223 World Gold Price (X6)_ Velocity of Cryptocurrency (W) + e

i. The t test Method

Table 3.8
Hypothesis Test Result

Dependent Variable: Return_Cryptocurrency_Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variables	coefficient	std. Error	t-Statistics	Prob.
C	22.42241	8.312424	6.143555	0.0000
BETA_CRYPTOCURRENCY_X1	1.535215	0.039595	2.634642	0.0053
LEVELS_TLEAN_FLOWER_X2	2.941466	2.413356	1.903953	0.0011
KURS_EYE_UANG_X3	3.348686	4.029455	3.385232	0.0102
PRICE_OIL_DUNIA_X4	1.617557	0.058236	0.745233	0.5303
PRICE_BATU_BARA_X5	-2.72457	2.241395	-1.52763	0.3722
PRICE_GOLD_DUNIA_X6	3.892556	4.620494	2.098527	0.0032
INFLATION_Z	-1.61713	2.254123	-1.41234	0.2505
VELOCITY_OF_CRYPTOCURRENCY_W	3.127722	6.105992	1.005224	0.3124
Moderating Effect Results				
BETA_CRYPTOCURRENCY_X1_INFLATION_Z	2.343741	0.632781	4.039714	0.0000
LEVEL_SUKU_INFLATION_X2_INFLATION_Z	0.917378	1.423019	2.013933	0.0022
KURS_EYE_UANG_X3_INFLASI_Z	0.901333	1.241555	1.746128	0.2225
PRICE_OIL_DUNIA_X4_INFLATION_Z	1.514427	2.031831	0.636212	0.4166
PRICE_BATU_BARA_X5_INFLATION_Z	2.762621	0.830392	0.641252	0.5011
PRICE_GOLD_DUNIA_X6_INFLATION_Z	3.123381	1.531617	2.475163	0.0009
BETA_CRYPTOCURRENCY_X1_VELOCITY_OF_CRYPTOCURRENCY_W	4.738733	1.028284	2.021384	0.0034
LEVEL_SUKU_BUNGA_X2_VELOCITY_OF_CRYPTOCURRENCY_W _Z	2.251281	1.412627	3.042948	0.0000
KURS_EYE_UANG_X3_VELOCITY_OF_CRYPTOCURRENCY_W	1.123474	2.029481	2.472825	0.0014
PRICE_OIL_DUNIA_X4_	1.748211	0.626261	0.726421	0.4255

VELOCITY_OF_CRYPTOCURRENCY_W				
PRICE_BARU_BAR_X5_VELOCITY_OF_CRYPTOCURRENCY_W	0.124216	2.048272	3.402842	0.0000
PRICE_GOLD_DUNIA_X6_VELOCITY_OF_CRYPTOCURRENCY_W	0.867223	1.042811	1.764272	0.2498

Results of Joint Moderating Effects

BETA_CRYPTOCURRENCY_X1_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	2.981939	2.041384	1.049393	0.6331
LEVEL_SUKU_BUNGA_X2_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	2.212164	1.014384	2.039399	0.0025
KURS_CURRENCY_UANG_X3_INFLASI_Z_VELOCITY_OF_CRYPTOCURRENCY_W	1.271938	0.351723	2.841293	0.0008
PRICE_OIL_DUNIA_X4_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	0.261421	2.417390	1.031893	0.4133
PRICE_BATU_BAR_X5_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	2.421330	1.043938	3.134636	0.0000
PRICE_GOLD_DUNIA_X6_INFLATION_Z_VELOCITY_OF_CRYPTOCURRENCY_W	1.182877	1.041381	1.484346	0.4184

R-squared	0.641242	Mean dependent var	8.413422
Adjusted R-squared	0.590921	SD dependent var	11.424222
SE of regression	17.042922	Sum squared residue	4.192829
F-statistics	7.094813	Durbin-Watson stat	3.004728
Prob(F-statistic)	0.000109		

Unweighted Statistics

R-squared	0.415362	Mean dependent var	14.09383
Sum squared residue	141523.55	Durbin-Watson stat	2.732853

Partial t-test testing is to test whether there is a positive effect or to determine the significance of each variable individually, so that it can be seen whether the assumptions that already exist can be accepted or rejected.

i. Based on the test results using the Eviews 10 application, it is known that the tcount value of Beta Cryptocurrency (X1) is 2.634642 with a significant 0.0053. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that Beta Cryptocurrency (X1) has a positive and significant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (2.634642) > ttable (1.99254) and a significant value of 0.0053 <0.05. So it can be concluded that the Beta Cryptocurrency variable (X1) has a positive and

significant effect on Return Cryptocurrency (Y). The results of this study are in line with the research conductedIsfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Ronnie Togar Mulia Sirait, Maulana Majied Sumatrani Saragih. (2021), entitled Cryptocurrency Return Assessment Model Based on Negative Risk Factors and Determinant Effect by Velocity of Cryptocurrency Pattern: an Emperical Objective Report from Indonesia Cryptocurrency Exchange.

j. Based on the test results using the Eviews 10 application, it is known that the tcount value of the Interest Rate (X2) is 1.903953 with a significance of 0.0011. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that the Interest Rate (X2) has a positive and insignificant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (1.903953) < ttable (1.99254) and a significant value of 0.0011 <0.05. So it can be concluded that the Interest Rate variable (X2) has no significant effect on Return Cryptocurrency (Y). This research is not in line with research conducted byRico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra, Wahyuddin Albr (2019). Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On Cryptocurrency In Indonesia.
k. Based on the test results using the Eviews 10 application, it is known that the tcount value of the Currency Exchange (X3) is 3.385232 with a significance of 0.0102. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that the Currency Exchange (X3) has a positive and significant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (3.385232) > ttable (1.99254) and a significant value of 0.0102 <0.05. So it can be concluded that the Currency Exchange variable (X3) has a significant effect on Return Cryptocurrency (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.
l. Based on the test results using the Eviews 10 application, it is known that the tcount value of World Oil Prices (X4) is 0.745233 with a significance of 0.5303. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that the World Oil Price (X4) has a positive and significant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (0.745233) < ttable (1.99254) and a significant value of 0.5303 > 0.05. So it can be concluded that the variable World Oil Prices (X4) has no significant effect on Cryptocurrency Returns (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.
m. Based on the test results using the Eviews 10 application, it is known that the tcount value of Coal Prices (X5) is -1.52763 with a significance of 0.3722. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that the price of coal (X5) has a negative and insignificant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (-1.52763) < ttable (1.99254) and a significant value of 0.3722 > 0.05. So it can be concluded that the variable Coal Price (X5) has no significant effect on Return Cryptocurrency (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.
n. Based on the test results using the Eviews 10 application, it is known that the tcount value of the World Gold Price (X6) is 2.098527 with a significance of 0.0032. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that the World Gold Price (X6) has a positive and significant effect on Return Cryptocurrency (Y). This is shown by the results of

the tcount (2.098527) > ttable (1.99254) and a significant value of 0.0032 > 0.05. So it can be concluded that the World Gold Price variable (X6) has a significant effect on Cryptocurrency Returns (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.

o. Based on the test results using the Eviews 10 application, it is known that the tcount value of Inflation (Z) is -1.41234 with a significance of 0.2505. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that inflation (Z) has a negative and insignificant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (-1.41234) < ttable (1.99254) and a significant value of 0.2505 > 0.05. So it can be concluded that the inflation variable (Z) has no significant effect on Return Cryptocurrency (Y). This research is in line with research conducted byRico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra (2019). Comparative of the Supply Chain and Block Chains to Increase the Country Revenues via Virtual Tax Transactions and Replacing Future of Money.
p. Based on the test results using the Eviews 10 application, it is known that the tcount value of the Velocity of Cryptocurrency (W) is 1.005224 with a significance of 0.3124. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that the Velocity of Cryptocurrency (W) has a positive and insignificant effect on Return Cryptocurrency (Y). This is shown by the results of the tcount (1.005224) < ttable (1.99254) and a significant value of 0.3124 > 0.05. So it can be concluded that the variable Velocity of Cryptocurrency (W) has no significant effect on Return Cryptocurrency (Y). This research is in line with research conducted byIsfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Mangasih Sinurat, Saharudin. (2021). Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On Cryptocurrency In Indonesia.

j. **F Test (Simultaneous)**

The F test is used to determine whether the independent variables jointly (simultaneously) affect the dependent variable.

a. Based on the test results using the Eviews 10 application, it is known that the calculated F value is7.094813significantly0.000109. The ftable value in this study is calculated by df = 520-k-1 which is 2.22 with a significance of 0.05. So it can be seen that Beta Cryptocurrency (X1), Interest Rates (X2), Currency Exchange Rates (X3), World Oil Prices (X4), Coal Prices (X5) and World Gold Prices (X6) have a positive and significant simultaneous effect on Cryptocurrency Returns (Y). This is shown by the results of the tcount (7.094813) > ttable (2.22) and a significant value0.000109< 0.05. So it can be concluded that the variables Beta Cryptocurrency (X1), Interest Rates (X2), Currency Exchange (X3), World Oil Prices (X4), Coal Prices (X5) and World Gold Prices (X6) have a significant effect simultaneously on Cryptocurrency Returns (Y).

k. **Moderating Effect Test Results**

Test the hypothesis in this study using Moderated Regression *Analysis*(MRA). MRA is a special application of linear multiple regression where in the regression equation contains elements of interaction (multiplication two or more independent variables). MRA aims to test relationships between the independent and dependent variables that are in that relationship there are factors that strengthen or weaken (moderating variable).

a. The MRA coefficient value of the interaction is known*Cryptocurrency betas*

(X1)_Inflation (Z) against*Return Cryptocurrencies*(Y)positive value, namely 4.039714 with Tcount 4.039714>1.99254and a p-value of 0.0000 <0.05 this indicates a variableInflation (Z) is a moderator variable that affects the relationship between*Cryptocurrency betas* (X1) with*Return Cryptocurrencies*(Y).

b. The MRA coefficient value of the interaction is knownInterest Rate (X2)_Inflation (Z) against*Return Cryptocurrencies*(Y)positive value, namely 2.013933 with Tcount 2.013933>1.99254and the p-value is 0.0022 <0.05, this indicates a variableInflation (Z) is a moderator variable that affects the relationship betweenInterest Rate (X2)with*Return Cryptocurrencies*(Y).
c. The MRA coefficient value of the interaction is knownCurrency Exchange (X3)_Inflation (Z) against*Return Cryptocurrencies*(Y)positive value, namely 1.746128 with Tcount 1.746128 <1.99254and the p-value is 0.2225 > 0.05, this indicates a variableInflation (Z) is a moderator variable that affects the relationship betweenCurrency Exchange (X3)with*Return Cryptocurrencies*(Y).
d. The MRA coefficient value of the interaction is knownWorld Oil Prices (X4)_Inflation (Z) against*Return Cryptocurrencies*(Y)has a positive value of 0.636212 with Tcount 0.636212 <1.99254and the p-value is 0.4166 > 0.05, this indicates a variableInflation (Z) is a moderator variable that affects the relationship betweenWorld Oil Prices (X4)with*Return Cryptocurrencies*(Y).
e. The MRA coefficient value of the interaction is knownCoal Price (X5)_Inflation (Z) against*Return Cryptocurrencies*(Y)has a positive value of 0.641252 with Tcount 0.641252 <1.99254and the p-value is 0.5011 > 0.05, this indicates a variableInflation (Z) is a moderator variable that affects the relationship betweenCoal Price (X5)with*Return Cryptocurrencies*(Y).
f. The MRA coefficient value of the interaction is knownWorld Gold Price (X6)_Inflation (Z) against*Return Cryptocurrencies*(Y)positive value, namely 2.475163 with Tcount 2.475163>1.99254and a p-value of 0.0009 <0.05 this indicates a variableInflation (Z) is a moderator variable that affects the relationship betweenWorld Gold Price (X6)with*Return Cryptocurrencies*(Y).

l. **Joint Moderating Effect Test Results**

Test the hypothesis in this study using Moderated Regression *Analysis*(MRA).

a. The MRA coefficient value of the interaction is known*Cryptocurrency betas* (X1)_Velocity of Cryptocurrencies (W)toInflation (Z) is positive ie1.049393with Tcount1.049393<1.99254and the p-value is 0.6331 > 0.05, this indicates a variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship between*Cryptocurrency betas* (X1) with*Return Cryptocurrencies*(Y).
b. The MRA coefficient value of the interaction is knownInterest Rate (X2)_Velocity of Cryptocurrencies (W)toInflation (Z) is positive ie2.039399with Tcount2.039399>1.99254and a p-value of 0.0025 <0.05 this indicates a variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenInterest Rate (X2)with*Return Cryptocurrencies*(Y).
c. The MRA coefficient value of the interaction is knownCurrency Exchange (X3)_Velocity of Cryptocurrencies (W)toInflation (Z) is positive ie2.841293with Tcount2.841293>1.99254and a p-value of 0.0008 <0.05 this indicates a variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenCurrency Exchange (X3)with*Return Cryptocurrencies*(Y).
d. The MRA coefficient value of the interaction is knownWorld Oil Prices (X4)_Velocity of Cryptocurrencies (W)toInflation (Z) is positive ie1.031893with Tcount1.031893<1.99254and the p-value is 0.4133 <0.05, this indicates a variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the

relationship betweenWorld Oil Prices (X4)with*Return Cryptocurrencies*(Y).

e. The MRA coefficient value of the interaction is knownCoal Price (X5)_Velocity of Cryptocurrencies (W)toInflation (Z) is positive ie3.134636with Tcount3.134636>1.99254and a p-value of 0.0000 <0.05 this indicates a variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenCoal Price (X5)with*Return Cryptocurrencies*(Y).
f. The MRA coefficient value of the interaction is knownWorld Gold Price (X6)_Velocity of Cryptocurrencies (W)toInflation (Z) is positive ie1.484346with Tcount1.484346<1.99254and the p-value is 0.4184 > 0.05, this indicates a variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenWorld Gold Price (X6)with*Return Cryptocurrencies*(Y).

4. CONCLUSIONS

Based on the results of data analysis and discussion that has been done on the previous chapter, the researcher draws several conclusions as follows:

22. It can be concluded that the variable Beta Cryptocurrency (X1) has a positive and significant effect on Return Cryptocurrency (Y).
23. It can be concluded that the Interest Rate variable (X2) has no significant effect on Return Cryptocurrency (Y).
24. It can be concluded that the Currency Exchange variable (X3) has a significant effect on Return Cryptocurrency (Y).
25. It can be concluded that the variable World Oil Prices (X4) has no significant effect on Cryptocurrency Returns (Y).
26. It can be concluded that the Coal Price variable (X5) has no significant effect on Return Cryptocurrency (Y).
27. It can be concluded that the World Gold Price variable (X6) has a significant effect on Cryptocurrency Returns (Y).
28. It can be concluded that the inflation variable (Z) has no significant effect on Return Cryptocurrency (Y).
29. It can be concluded that the Velocity of Cryptocurrency (W) variable has no significant effect on Return Cryptocurrency (Y).
30. It can be concluded that the variable Beta Cryptocurrency (X1), Interest Rates (X2), Currency Exchange (X3), World Oil Prices (X4), Coal Prices (X5) and World Gold Prices (X6) have a significant effect simultaneously on Return Cryptocurrencies (Y).
31. VariableInflation (Z) is a moderator variable that affects the relationship between*Cryptocurrency betas* (X1) with*Return Cryptocurrencies*(Y).
32. VariableInflation (Z) is a moderator variable that affects the relationship betweenInterest Rate (X2)with*Return Cryptocurrencies*(Y).
33. VariableInflation (Z) is a moderator variable that affects the relationship betweenCurrency Exchange (X3)with*Return Cryptocurrencies*(Y).
34. VariableInflation (Z) is a moderator variable that affects the relationship betweenWorld Oil Prices (X4)with*Return Cryptocurrencies*(Y).
35. VariableInflation (Z) is a moderator variable that affects the relationship betweenCoal Price (X5)with*Return Cryptocurrencies*(Y).
36. VariableInflation (Z) is a moderator variable that affects the relationship betweenWorld Gold Price (X6)with*Return Cryptocurrencies*(Y).
37. Variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship between*Cryptocurrency betas* (X1) with*Return Cryptocurrencies*(Y).
38. Variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenInterest Rate (X2)with*Return Cryptocurrencies*(Y).
39. Variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the

relationship betweenCurrency Exchange (X3)with*Return Cryptocurrencies*(Y).

40. Variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenWorld Oil Prices (X4)with*Return Cryptocurrencies*(Y).
41. Variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenCoal Price (X5)with*Return Cryptocurrencies*(Y).
42. Variable*Velocity of Cryptocurrency*(W)is a moderator variable that affects the relationship betweenWorld Gold Price (X6)with*Return Cryptocurrencies*(Y).

BIBLIOGRAPHY

Apsara, RH, & Indriani, A. 2017. Analysis of the Effect of Crude Oil Price, Earning Per Share, Price To Book Value, Return On Assets and Debt To Equity Ratio on Share Prices of Coal Companies Listed on the Indonesia Stock Exchange Period (2012-2016)). Diponegoro Journal Of Management, 6(4), 1–13.

Asmar, M., Ahmad, Z. 2011. Market microstructure: The components of black-box. International Journal of Economics and Finance, Vol. 3(1).

Ayem, Sri. 2016. Effect of Profitability, Capital Structure, Dividend Policy, and Investment Decisions on Firm Value. Journal of Accounting Vol. 4(1).

Falkner, EM, & Hiebl, MR 2015. Risk Management in SMEs: A Systematic Review of Available Evidence. The Journal of Risk Finance, Vol. 16(22).

Ho, C., & Hung, C. (2009). Investor sentiment as conditioning information in asset pricing. Journal of Banking & Finance, 33(5), 892-903.

Ilham, RN, Erlina, Fachrudin, KA, Silalahi, AS, Saputra, J., Albr, W., 2019. Investigation of the Bitcoin Effects on the Country Revenues via Virtual Tax Transactions for Purchasing Management. International Journal of Supply Chain Management. Vol. 8(6).

Ilham, RN, Erlina, Fachrudin, KA, Silalahi, AS, Saputra, J. 2019. Comparative of the Supply Chain and Block Chains to Increase the Country Revenues via Virtual Tax Transactions and Replacing Futures of Money. International Journal of Supply Chain Management. Vol. 8(5).

Ilham, RN, Fachrudin, KA, Pakpahan, EE 2019. The Challenge in Application of Cryptocurrency as Commodity in Indonesia. International Conference on Finance, Economics and Business.

Ilham, RN, Sadalia, I., Irawati, N., Sinta, Irada. 2022. Al Qalam: Religious and Society Scientific Journal. Vol. 16(1).

Kaluge, D. (2019). Multifactor On Macroeconomic Fundamentals To Explain The Behavior Of Sectoral Indices In The Indonesian Stock Exchange. Entrepreneurship And Sustainability Issues.

Komalasari, YT (2019). Analysis of Mining Sector Stock Index Movement on the Indonesia Stock Exchange. Journal of Business and Management (Jbima), 7(1), 1–17.

Koskei, L. 2017. The Effect of Exchange Rate Risk on Stock Returns in Kenya's Listed Financial Institutions. Research Journal of Finance and Accounting. Vol. 8(3).

Liu, Y., & Tsyvinski, A. 2018. Risks and Returns of Cryptocurrency. SSRN Electronic Journal.

Lento, GLD, Latif, IN, & Verahastuti, C. 2019. Analysis of Share Portfolios in Mining Sub-Sector Companies Listed on the Indonesia Stock Exchange (BEI) Using the Capital Asset Pricing Model (Capm) Approach and Arbitrage Pricing Theory (Apt). Journal Of Indonesian Science Economic Research, 1(2), 12–19.

Malla, N., & Asianto, A. 2020. The Determinant Of Mining Sector Stock Price Index At Indonesia Stock Exchange. International Journal Of Academic Research In Accounting, Finance And Management Sciences. Vol. 10-13, 7678.

Mankiw, N, Gregory, 2003, Macroeconomics, Worth Publishers: 271.

Penman, S., & Reggiani, F. 2013. Returns to buying earnings and book value: Accounting for growth and risk. Review of Accounting Studies, Vol. 18(4).

Putra, RD, et al. 2013. Analysis of Stock Investment Selection Using the Capital Asset Pricing Model (CAPM) Method and the Reward to Variability Ratio (RVAR) as a Determinant of Stock Investment Decision Making. Journal of Business Administration. Vol. 1(2).

Sadalia, I., Irawati, N., Ilham, RN, Hasibuan, AN, Sirait, RTM, Saragih, MMS 2021. Cryptocurrency Return Assessment Model Based on Negative Risk Factors And Determinant Effect By Velocity of Cryptocurrency Pattern: an Empirical Objective

Report from Indonesia Cryptocurrency Exchange. The International Journal of Accounting.

Sadalia, I., Irawati, N., Ilham, RN, Hasibuan, AN, Sinurat, M., Saharudin. 2021. Conjuncture Fluctuation Effect From Commodity Supercycle Pattern: Empirical Case Between Velocity And Risk Factor On Cryptocurrency In Indonesia. The International Conference on Business and Management of Technology. Vol. 202.

Siringoringo, Renniwaty. 2017. Analysis of the Indonesian Banking Intermediation Function (Case Study of Conventional Commercial Banks Listed on the IDX for the 2012-2016 Period). Journal of Business and Management Inspiration. Vol. 1(2).

John, Augustine. 2009. Measurement of Agent Interaction and Its Effect on Stock Trading Volatility on the Indonesian Stock Exchange.

Lampiran 3. LoA Prosiding

INTERNATIONAL CONFERENCE ON BUSINESS, MANAGEMENT AND TECHNOLOGY

Magister Manajemen Wilayah Barat Indonesia

Date: 20/10/2022 20:11:32
No:55/ICBMT/10/2022

Dear Author:
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LETTER OF ACCEPTANCE

Congratulations!

The conference organizing committee is pleased to announce that your submission abstract entitled THE THREE WAY INTERACTION METHOD OF CRYPTOCURRENCY RISK PREDICTION MODEL AROUND THE WORLD: PRESENT VALUE REALITY ASSET BASED ON MACROECONOMIC FACTORS AND INTERNAL RISK FUNDAMENTAL AT MOMENT OF COVID-19 has been accepted for presentation at the 1st International Conference on Business, Management, and Technology (ICBMT-2022). Hosted by Asosiasi Magister Manajemen Wilayah Barat Indonesia (AMMWBI). All full papers will be peer-reviewed before publishing. During publication, the AMMWBI publication team may ask you to revise your submission.

Thank you for your interest and cooperation.

Yours sincerely,

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Lampiran 4 . Sertifikat Prosiding

Magister Manajemen Wilayah Barat Indonesia

International Conference On Business, Management And Technology

Batam during 25-26 November, 2022

Certificate of Presenter

This is to certify that

Nisrul Irawati

Universitas Sumatera Utara, Indonesia

Delivered an Oral Presentation entitled
" Comparative Analysis Of The Idx 30 Stock Optimal Portfolio With The Performance Of Mutual Fund Portfolio In Indonesia For The 2019-2021 Period"
At first International Conference On Business, Management And Technology.

Prof.Dr.Isfenti Sadalia, SE., ME
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Lampiran 5. Prosiding Internasional

THE THREE WAY INTERACTION METHOD OF CRYPTOCURRENCY RISK PREDICTION MODEL AROUND THE WORLD: PRESENT VALUE REALITY ASSET BASED ON MACROECONOMIC FACTORS AND INTERNAL RISK FUNDAMENTAL AT MOMENT OF COVID-19

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Abstract. Decisions in choosing investment instruments can be made by buying shares of Indonesian stock exchange-listed companies and the cryptocurrency market.All over the world, investments in cryptocurrencies or digital assets are becoming more common, and Indonesia is no exception.The return that investors anticipate receiving in the future is referred to as the expected profit or expected return.The population of this quantitative study consists of ten cryptocurrency coins with the largest market caps in the world.This study uses pooled data as the type of data.panel data) will be collected over the course of two years, from January to December 2021, during the COVID-19 pandemic. This will be done by collecting cryptocurrency weekly transaction report data, resulting in a target population of 520 observations (52 weeks x 10 coins) over the course of two years.A sample of 520 data from the weekly transaction report are used in this study.In this study, descriptive statistics, a data stationarity test, a classical

assumption test, a moderating hypothesis, a three-way interaction regression model, and joint moderating effects regression analysis are all used to test research hypotheses using quantitative data analysis.It is evident that the market capitalization of a number of cryptocurrencies is quite high, indicating that investing in digital asset instruments based on cryptocurrencies offers a substantial profit opportunity but must be accompanied by risk management.The return that investors anticipate receiving in the future is referred to as the expected profit or expected return.The trading weight and interest of the five cryptocurrencies—Bitcoin (BTC), Ethereum (ETH), Ripple (XRP), Bitcoin Cash (BCH), Litecoin (LTC), Stellar, DASH, Dogecoin, Zcash, and Monero—continues to rise in 2020 and 2021 in conjunction with the COVID-19 pandemic. As a result, these cryptocurrencies have a higher rate of return than other cryptocurrencies.The novelty that followed is in the form of a new concept in investment called velocity of cryptocurrency, this variable has never been studied in the concept of investment management and in the future it is hoped that more and more parties will develop research on the rate of turnover and movement of cryptocurrency digital assets, then valuation models and asset price predictions. digital cryptocurrency based on fundamental risk factors and fluctuations in world commodity prices called the cryptocurrency risk prediction model, and legal cryptocurrency and tax returns which are formulated by carrying out focus group discussions on tax levy policies on buying and selling transactions of cryptocurrency digital assets.

Keywords: ***cryptocurrency; world commodities price; internal risk fundamental factors, macroeconomics.***

1. INTRODUCTION

Investment is an Funding immediately or circuitously, as well as investments that are made for either a short or long period of time with the intention of earning the anticipated profit or other benefits from the investment itself.Beginning with the, there is a preferred return investment.This is evident from the blockchain representation, whose impact is immediately admired by the public (clients), and there are numerous other possibilities that can be investigated. As a result, interest in cryptocurrencies, typically used as a funding instrument, has only significantly increased shortly after the Bitcoin alternate price experienced a significant spike.adequate excess.Data encryption and certain processes are used to create the bitcoin cryptocurrency algorithms.

This situation is coupled with the fact that in 2020 the world's economic growth rate weakened quite sharply but the price position of cryptocurrency digital assets remained stable and was even able to reach the highest price over the past decade, which increased up to 250% from the previous year. Table 1 explains transaction data and market capitalization in countries that make the largest transactions on Bitcoin Cryptocurrency, that Indonesia is one of the countries with the largest number of digital asset transactions in the world.

Table 1.1
Cryptocurrency Transactions and Market Capitalization

Cryptocurrency	Market Cap (USD) 31 December 2020	Market Cap (BTC) 31 December 2020
Bitcoin	531,650,756,634,144	18.586.500.000001
Etherum	83.693.010.16243	2,925,612,939971

Source: BTC live CoinMarketCap 2021

It can be seen that the market capitalization of several cryptocurrencies is quite large in value, illustrating that investing in cryptocurrency digital asset instruments has a large enough profit opportunity, but must be accompanied by risk control. One of the most critical elements of reading investing is a way to degree danger and return. The definition of risk and go back will in no way be the same from one investor to some other, even the extent of desire for chance and go back will in no way be the equal (Liu & Tsyvinski, 2018). Every investor who desires to maximize wealth could be drawn to an funding that provides a better stage of expected return as compared to different investment opportunities. The expected profit (expected go back) is the go back that is expected to be obtained by using investors inside the destiny. Based on the reality that almost all investments incorporate uncertainty or risk (Koskei, 2017).

The mining industry supports the Indonesian economy in that revenue from sales taxes and royalties can be allocated to support economic development (Apsara & Indriani, 2017). Indonesia is also one of the countries with very high mineral reserves potential which occupies the 24th position as the largest exporting country in the world with the largest export of mining commodities in Indonesia dominated by coal, tin, copper and gold. The shares of companies in the mining sub-sector tend to fluctuate (Kaluge, 2019; Lento, Latif, & Verahastuti, 2019; Malla & Asianto, 2020). However, the entry of foreign investors in mining stocks also encourages local investors to buy these shares which will lead to an increase in mining share prices (Komalasari, 2019). The research objective in the form of a documentation study intended in this research is to find secondary data. Therefore, following the specifications of the research scheme, in accordance with the USU Strategic Plan which focuses on TALENTA, which is based on local wisdom by providing empirical evidence about the influence of macroeconomic factors that will have an impact, both in the form of gains and losses to investors in the transaction process of crypto digital assets..

1.7 Formulation of the problem

Based on the history of the trouble that has been defined, the system of the hassle on this look at is:

7. Do risk factors and word commodity prices have an influence on cryptocurrency returns?
8. Do risk factors and word commodity prices have an influence on cryptocurrency returns with inflation as a moderation?
9. Do risk factors and word commodity prices have an influence on cryptocurrency returns with inflation as moderating and velocity of cryptocurrency as a joint moderating effect?

2. MATERIALS AND METHODS

2.9 *Market Microstructure Theory*

Market Micro Structure, namely “The study of the process and results of trading assets in accordance with specific buying and selling policies."According

to O'Hara's concept, the purpose of this investigation is to discuss the manner in which asset charges are shaped in a market with current buying and selling guidelines.Market microstructure is defined by Asmar and Ahmad (2011) as the study of trading mechanisms and policies used to reap alternate. Interaction between agents is also a topic in the micro structure of the market and for Indonesia (John, 2009). Each agent has a strategy in conducting transactions where fundamentals use the opportunity cost approach to share ownership and technical analysis uses a technical analysis approach.

2.10 *Signaling Theory*

*Signaling theory*are effects arising From the assertion of monetary statements which can be captured by users of financial statements (mainly traders). Signaling principle states that businesses which can be capable of generate income generally tend to boom their debt due to the fact the additional interest paid may be offset by means of income earlier than tax (Ayem, 2016). The signaling effect is generated by using new statistics, and not by means of troubles that occur (Penman, & Reggiani, 2013). Thus, a company with very favorable prospects avoids selling shares, and instead raises the new capital needed by using new debt even though this would be a debt ratio above the target level.

2.11 *Capital Asset Pricing Model*

The very important thing that needs to be done by an investor is to have the ability to estimate the return of a security (Putra, et al. 2013). Therefore, there is a model that can be used to estimate the return of a security stock, namely The Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model (CAPM) is a model or method for estimating the go back fee of an asset by way of comparing the variable return received and the hazard borne.

2.12 *Risk Management*

Risk management is becoming more important in the financial sector compared to other economic sectors (Falkner, & Hiebl, 2015). Mankiw (2003) explains that the exchange rate between two countries is the price of the currency used by residents of that country to trade with each other. Ho and Hung (2009) also use conditional betas on investor sentiment, default spreads and stock characteristics and then find that investment sentiment also helps to better capture the impact of anomalies in the stock price model. We will also implement a conditional beta that depends on the uncertainty, characteristics of the cryptocurrency, and Bitcoin returns.

2.13 *Economic Theory Of Regulation*

Banking regulations in Indonesia are typically carried out by the Bank of Indonesia in the form of circulars, which may be continuously revised in light of the current state of the nation's banking system.As the creator of the monetary theory of law, Siringoringo (2017) asserts that regulation is the act of suppressing organizations that produce legal guidelines and regulations to guide businesses and protect customers, employees, and the surroundings.

2.14 Research Framework

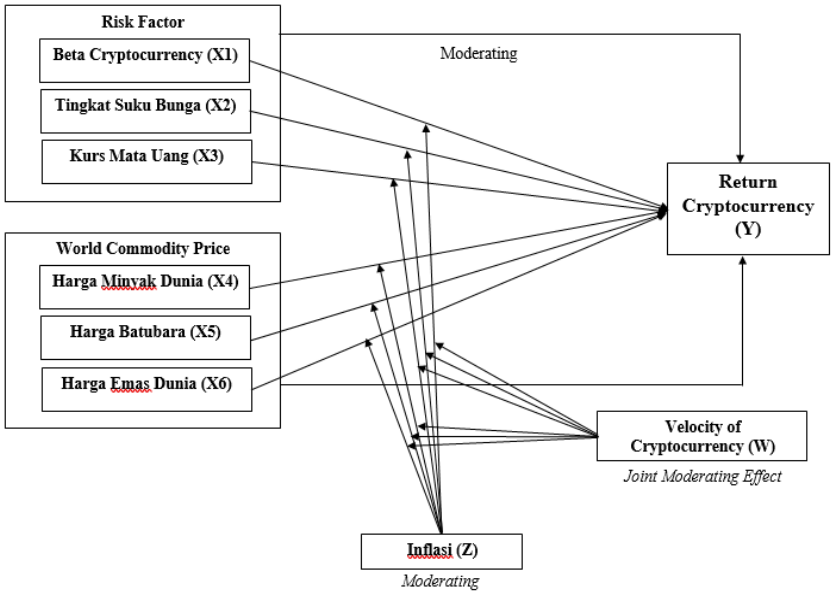

Figure 2.1
Research Framework

2.15 Types of research

This type of Studies is Studies that explain the causal relationship between the independent variable and the dependent variable are known as quantitative descriptive and explanatory studies.

2.16 Population and Sample

The population of this research is ten Bitcoin (BTH), Ethereum (ETH), Ripple (XRP), Bitcoin Cash (BCH), Litecoin (LTC), Stellar, DASH, Dogecoin, Zcash, and Monero are the cryptocurrencies with the largest market caps in Indonesia.within Indonesia.Pooled Data (Panel Data) taken during the Covid-19 pandemic from January 2020 to December 2021 is the kind of data that this study used.This was accomplished by reviewing the book of weekly cryptocurrency transaction reports as a document.so that a target population of 520x1 years can be obtained, a sample of 520 weeks of data from 2020 and 2021 is taken from observations weekly transaction file data.

2.17 Engineering and Research

Primary and secondary Documentation Studies are the methods of data collection used in this study the shape of cryptocurrency go back statistics, beta cryptocurrencies, hobby quotes, forex rates, international oil fees, coal fees, international gold charges, inflation and pace of cryptocurrencies obtained from Blockchain.Data and different online Exchanges. The statistics used on this look at is weekly transaction statistics starting from January to December 2020 in the course of the covid pandemic. One of the primary websites in information collection in this observe iswww.Indodax.Comandwww.Coin-geco.Comwhich provides direct cryptocurrency change services. This observe makes use of the explanatory case observe method to provide an explanation for the affect among the variables used on this have a look at thru testing the studies hypotheses that

have been determined. While the technique used is Pooled Data.

1. Data analysis technique

Quantitative data analysis in this Take a look at is to analyze what factors have an effect on the go back on cryptocurrencies. Before making conclusions in a research evaluation of the facts have to be done in order that the studies results are accurate. So this research was conducted the use of statistical strategies assisted through the E-VIEWS 10 software. The evaluation on this examine used panel statistics that's a mixture of time-series records and cross-sectional statistics.

The following is the regression equation of the Multiple Regression Analysis Panel Model that will be used in this study are as follows:

Equation: Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7Z + b8W+ ei

The following is the regression equation of the Three way Interacttion And Joint Moderating Effects Regression Analysis Model that will be used in this study are as follows:

Equation: Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7Z + b8W + b9X1Z + b9X2.*Z + b10X3*Z + b11X4*Z + b12X5*Z + b13X6*Z + b14X2*W + b15X2*W + b15X5* *W + b16X3*W + b17X4*W + b18X5*W + b19X6*W + b20Z*W + b21X1Z*W + b22X2.Z*W + b23X3Z*W + b24X4Z*W + b25X5Z*W + b26X6Z*W + ei

3. RESULTS AND DISCUSSION

3.1 Data Analysis Results

To see how to get a good model in panel data regression analysis, a model selection technique is needed. This have a look at uses panel information regression analysis technique, which is a mixture of time-series data and pass-sectional records. Panel records regression consists of 3 models, namely Common Effect Model (CEM), Fixed Effect Model (FEM) and Random Effect Model (REM). The following are the outcomes of testing the three models in this study:

Table 3.1 Results of the Third Panel Data Testing Model

variable	Common Effect Model (CEM)		Fixed Effect Model (FEM)		Random Effect Model (REM)	
	coefficient	Sig	coefficient	Sig	coefficient	Sig
C	23.41343	0.000	20.13412	0.022	19.03828	0.000
Cryptocurrency Beta(X1)	2.121424	0.005	1.652355	0.008	1.049001	0.012
Interest Rate (X2)	2.343441	0.012	2.241345	0.011	3.091883	0.033
Currency Rate (X3)	1.525222	0.031	2.121244	0.021	1.009381	0.041
World Oil Prices (X4)	1.024583	0.000	1.521435	0.004	2.262800	0.047
Coal Price (X5)	5.049237	0.011	2.004544	0.022	1.412722	0.019
World Gold Price (X6)	1.903856	0.023	2.041222	0.019	1.462721	0.051
Inflation (Z)	3.120529	0.033	3.162464	0.027	2.946272	0.049
Velocity of Cryptocurrency (W)	1.542386	0.009	2.142356	0.008	1.093877	0.048

Source : Output Eviews (Processed Data), 2022

As can be seen from the table above, this study's Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) serve as the sole foundation for all panel statistics regression coefficients and significance values.

3.2 Chow test

Chow test is a test designed to determine which model is best among the Common Effect Model (CEM) and Fixed Effect Model (FEM).The chosen model is CEM if the chow test results are significant (probability> 0.05), and the chosen model is FEM if The results of the chow test are significant (probability 0.05).

Table 3.2 Chow Test Results

Effects Test	Statistics	df	Prob.
Cross-section F	8.841248	(65,190)	0.0000
Cross-section Chi-square	211.842741	520	0.0000

Source: research results, 2022

Based on The chow check desk, it shows that the probability value within the chow take a look at is0.0000. This value is beneath the same old error tolerance value in this look at, which is 0.05. Therefore, primarily based at the excellent version in this observation is the result of the chow test Fixed effect model (FEM).

3.3 Hausman test

The next test So one can be used is the Hausman test. The Hausman take a look at is a take a look at that compares the Fixed effect model (FEM) and the Random Effect Model (REM). The best model is the Fixed Effect Model (FEM) if the chance cost is less than the 0.05 error cost, while the best version is the Random Effect Model if the chance cost is higher than the 0.05 error cost.

Table 3.3 Hausman Test Results

Test Summary	Chi-Sq. Statistics	Chi-Sq. df	Prob.
Cross-section random	0.263449	6	0.9138

Source: research results, 2022

Based on the Hausman test table above,it can be seen that the Possibility fee in the Hausman check is 0.9138. This fee is above the standard errors tolerance price in this observe, that's zero.05. Therefore, the quality panel facts regression version in this have a look at is the Random Effect Model (REM).

3.4 Normality Test Data

Normality test is Used to check whether or not the regression version no longer has a daily distribution. The effects of the Jarque-Bera check on this have a look at are proven as follows:

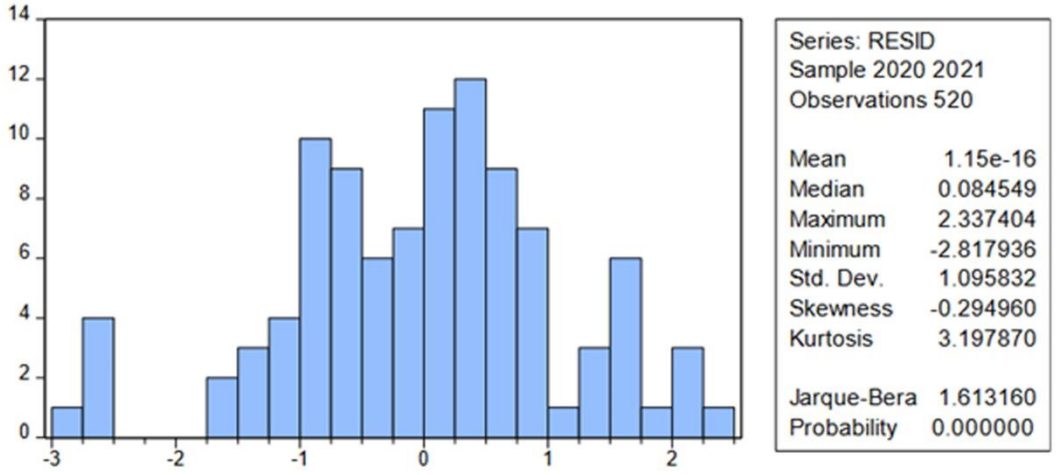

Figure 3.1
Normality Graph

Based on the As can be seen above, the Jarque-Bera check value is 1.613160, and the chance cost is 0.000000, which is lower than the typical error tolerance price of 5%.As a result, it is possible to conclude that the residuals are generally distributed.

3.5 The heteroscedasticity Test

The heteroscedasticity The purpose of the test is to ascertain whether the regression model exhibits an inequality of variance and residuals from one observation to the next.Homoscedasticity is when the variance of the residuals is constant from one observation to the next, and heteroscedasticity is when it is unique (Ghozali, 2012:101).

Table 3.4 Heteroscedasticity Test Results

Dependent Variable: RESABS
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	18.01248	11.31422	3.143555	0.0000
BETA_CRYPTOCURRENCY_X1	2.028424	0.312424	1.039593	0.1411
LEVEL_TRIATE_INTEREST_X2	1.135013	2.604393	1.131153	0.0856
EXCHANGE_EYE_MONEY_X3	2.413424	3.053531	3.004124	0.166
PRICE_OIL_DUNIA_X4	1.013842	0.11412	0.114401	0.513
PRICE_STONE_BARA_X5	-3.013492	2.256335	0.412442	0.4125
PRICE_GOLD_DUNIA_X6	2.023533	3.513534	-3.01349	0.0855
INFLATION_Z	-1.41222	1.535333	-1.14552	0.1384
VELOCITY_OF_CRYPTOCURRENCY_W	2.410422	4.246332	1.110533	0.6241

Effects Specification	SD	Rho
Cross-section random	13.13745	0.1577
Idiosyncratic random	20.53001	0.6043

Source : Output Eviews (Data (2022)

It is evident from the preceding table that all independent variables in the Glajser test are above 0.05.

3.6 Multicollinearity Test

Multicollinearity aims of the test Determine whether or not The independent variables are linked together (Independent) within the regression.There may not be multicollinearity if the independent variable correlation matrix is less than. Eight, whereas if the correlation among the impartial variables is above 0.8 then multicollinearity occurs. The following is a matrix desk of the consequences of multicollinearity testing in this observe.

Table 3.5 Multicollinearity Test Result

	R_C_Y	B_C_X1	T_S_B_X2	K_M_U_X3	H_M_D_X4	H_B_B_X5	H_E_D_X6	I_Z	V_C_W
R_C_Y	1000000	-0.241233	-0.120152	0.7235733	-1.021385	0.352385	0.736433	-0.05931	0.513444
B_C_X1	-0.084744	1000000	0.4000	0.517533	-0.12414	0.523255	-0.52303	-1.23039	0.134144
T_S_B_X2	-0.03844	0.4626525	1000000	0.53153	0.62541	-1.737422	0.424242	0.64514	0.64262
K_M_U_X3	0.013843	0.654122	0.4612742	1000000	0.745113	0.427424	0.72565	0.13133	-1.09913
H_M_D_X4	0.736111	0.152422	0.17424	0.515313	1000000	0.64124	0.6414	0.431545	0.41714
H_B_B_X5	0.413422	-0.012884	-0.74262	-0.625412	-0.51531	1000000	-0.64182	-1.02194	-0.12351
H_E_D_X6	0.262444	-1.736 43	0.64272	-1.01983	-0.35533	0.4321641	1000000	0.46212	-0.4124
I_Z	0.62462	0.017343	-0.42722	0.51433	0.761535	-0.74272	-0.64264	1000000	-.412461
V_C_W	-1.081373	0.412742	-1.427422	0.561813	0.51435	-0.426414	-1.42642	0.11091	1000000

Source : Output Eviews (Processed Data), 2022

Shows that this model does not have multicollinearity symptoms by looking at the output There is no output in the regression that is greater than between the independent variables 0.8.

3.7 Autocorrelation Test

The autocorrelation test aims to determine whether there is a connection

between's the mistake in period t-1 and the confounding errors in length t in a model. Ghozali (2012:124) states that an amazing regression model is a version that doesn't have autocorrelation in it.

Table 3.6 Autocorrelation Test Results

R-squared	0.084133	Mean dependent var	8.412424
Adjusted R-squared	3.013422	SD dependent var	10.24124
SE of regression	13.39393	Sum squared resid	427436.2
F-statistics	9.124012	Durbin-Watson stat	1.901831
Prob(F-statistic)	0.004235		

Source : Output Eviews (Processed Data), 2022

The In this study, the value of Durbin Watson reveals the autocorrelation test.In this study, the Durbin-Watson value is 1.901831; the number of samples is 520 (n), the number of independent variables is 6 (k = 2), and the value of Durbin-Watson, DW1.901831 is greater than the higher limit (du) of 1.8000 and the lower limit (dl) of 1.4029. With the table fee set at a significance level of 5%, it can be concluded that there may not be an autocorrelation in this regressionWith a lower restriction of 1.4029 and a higher restriction of 1.8000, respectively.

3.8 Multiple Linear Regression Model

Multiple linear regression A model is a version of statistical testing that aims to examine how the independent variable affects the established variable.The finest version is the Random Effect Model (REM) based on the model selection above. The results of board data relapse with the Random Effect Model (REM) are as per the following:

Table 3.7 Multiple Linear Regression Model Result

Dependent Variable: Return_Cryptocurrency_Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	21.41241	8.312424	6.143555	0.0000
BETA_CRYPTOCURRENCY_X1	1.525215	0.039595	2.634642	0.0053
LEVEL_TRIATE_INTEREST_X2	2.837466	2.413356	1.903953	0.0011
EXCHANGE_EYE_MONEY_X3	3.185686	4.029455	3.385232	0.0102
PRICE_OIL_DUNIA_X4	1.277557	0.058236	0.745233	0.5303
PRICE_STONE_BARA_X5	-2.47457	2.241395	-1.52763	0.3722
PRICE_GOLD_DUNIA_X6	3.745556	4.620494	2.098527	0.0032
INFLATION_Z	-1.53513	2.254123	-1.41234	0.2505
VELOCITY_OF_CRYPTOCURRENCY_W	3.028722	6.105992	1.005224	0.3124
BETA_CRYPTOCURRENCY_X1_INFLATION_Z	2.824741	0.632781	4.039714	0.0000
LEVEL_TRIATE_INTEREST_X2_INFLATION_Z	0.815378	1.423019	2.013933	0.0022
EXCHANGE_EYE_MONEY_X3_INFLATION_Z	0.637333	1.241555	1.746128	0.2225
PRICE_OIL_WORLD_X4_INFLATION_Z	1.009427	2.031831	0.636212	0.4166

PRICE_BATU_BARA_X5_ INFLATION_Z	2.612621	0.830392	0.641252	0.5011
PRICE_GOLD_DUNIA_X6_ INFLATION_Z	3.037381	1.531617	2.475163	0.0009
BETA_CRYPTOCURRENCY_X1_ VELOCITY_OF_CRYPTOCURRENCY_W	4.173733	1.028284	2.021384	0.0034
LEVEL_TRIB_INTEREST_X2_ VELOCITY_OF_CRYPTOCURRENCY_W _Z	2.127281	1.412627	3.042948	0.0000
EXCHANGE_EYE_MONEY_X3_ VELOCITY_OF_CRYPTOCURRENCY_W	1.029474	2.029481	2.472825	0.0014
PRICE_OIL_DUNIA_X4_ VELOCITY_OF_CRYPTOCURRENCY_W	1.048211	0.626261	0.726421	0.4255
PRICE_BATU_BARA_X5_ VELOCITY_OF_CRYPTOCURRENCY_W	0.743216	2.048272	3.402842	0.0000
PRICE_GOLD_DUNIA_X6_ VELOCITY_OF_CRYPTOCURRENCY_W	0.973263	1.042811	1.764272	0.2498
BETA_CRYPTOCURRENCY_X1_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.013939	2.041384	1.049393	0.6331
LEVEL_TRIATE_X2_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.743164	1.014384	2.039399	0.0025
EXCHANGE_EYE_MONEY_X3_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.041938	0.351723	2.841293	0.0008
PRICE_OIL_WORLD_X4_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	0.636421	2.417390	1.031893	0.4133
PRICE_BATU_BARA_X5_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.427330	1.043938	3.134636	0.0000
PRICE_GOLD_DUNIA_X6_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.903877	1.041381	1.484346	0.4184

R-squared	0.641242	Mean dependent var	8.413422
Adjusted R-squared	0.590921	SD dependent var	11.424222
SE of regression	17.042922	Sum squared resid	4.192829
F-statistics	7.094813	Durbin-Watson stat	3.004728
Prob(F-statistic)	0.000109		

Unweighted Statistics

R-squared	0.415362	Mean dependent var	14.09383
Sum squared resid	141523.55	Durbin-Watson stat	2.732853

Source : Output Eviews (Processed Data), 2022

Based at the desk above, the regression equation version that may be organized in this test is as follows:***Return Cryptocurrency*=21.412 + 1.525*Cryptocurrency Beta*(X1)+2.837Interest Rate(X2) + 3.185Currency Exchange(X3) + 1,277World Oil Prices(X4) – 2.474Coal Price(X5) + 3.745World Gold Price(X6) -1.535Inflation (Z) +3.028*Velocity of Cryptocurrency*(W) + 2.824*Cryptocurrency Beta*(X1)_ Inflation (Z) + 0.8153 Interest Rates (X2)_Inflation (Z) + 0.6373 Currency Exchange (X3)_ Inflation (Z) + 1.009 World Oil Prices (X4)_Inflation (Z) + 2.6126 Coal Prices (X5)_Inflation (Z) + 3,037 World Gold Price (X6)_Inflation (Z) + 4,173*Cryptocurrency Beta*X1_*Velocity of Cryptocurrency*(W) + 2,127 Interest Rate (X2)_*Velocity of Cryptocurrency*(W) + 1,029 Currency Exchange (X3)_*Velocity of Cryptocurrency*(W) + 1,048 World Oil Prices (X4)_*Velocity of Cryptocurrency*(W) + 0.743 Coal Price (X5)_*Velocity of Cryptocurrency*(W) + 0.973 World Gold Price (X6)_*Velocity of Cryptocurrency*(W) + e**

3.9 The t test method

The t test is used to partially examine the impact that the independent variable has on the established variable. The consequences of speculation trying out accomplished, it is able to be concluded that the partial check on this look at is possible to use if the selection-making criteria with the ttable cost then additionally observe the chance cost.

Table 3.8 Hypothesis Test Result

Dependent Variable: Return_Cryptocurrency_Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/11/22 Time: 20:12

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	21.41241	8.312424	6.143555	0.0000
BETA_CRYPTOCURRENCY_X1	1.525215	0.039595	2.634642	0.0053
LEVEL_TRIATE_INTEREST_X2	2.837466	2.413356	1.903953	0.0011
EXCHANGE_EYE_MONEY_X3	3.185686	4.029455	3.385232	0.0102
PRICE_OIL_DUNIA_X4	1.277557	0.058236	0.745233	0.5303
PRICE_STONE_BARA_X5	-2.47457	2.241395	-1.52763	0.3722
PRICE_GOLD_DUNIA_X6	3.745556	4.620494	2.098527	0.0032
INFLATION_Z	-1.53513	2.254123	-1.41234	0.2505
VELOCITY_OF_CRYPTOCURRENCY_W	3.028722	6.105992	1.005224	0.3124

Moderating Effect Results

BETA_CRYPTOCURRENCY_X1_ INFLATION_Z	2.824741	0.632781	4.039714	0.0000
LEVEL_TRIATE_INTEREST_X2_ INFLATION_Z	0.815378	1.423019	2.013933	0.0022
EXCHANGE_EYE_MONEY_X3_ INFLATION_Z	0.637333	1.241555	1.746128	0.2225
PRICE_OIL_WORLD_X4_ INFLATION_Z	1.009427	2.031831	0.636212	0.4166
PRICE_BATU_BARA_X5_ INFLATION_Z	2.612621	0.830392	0.641252	0.5011
PRICE_GOLD_DUNIA_X6_ INFLATION_Z	3.037381	1.531617	2.475163	0.0009
BETA_CRYPTOCURRENCY_X1_ VELOCITY_OF_CRYPTOCURRENCY_W	4.173733	1.028284	2.021384	0.0034
LEVEL_TRIB_INTEREST_X2_ VELOCITY_OF_CRYPTOCURRENCY_W _Z	2.127281	1.412627	3.042948	0.0000
EXCHANGE_EYE_MONEY_X3_ VELOCITY_OF_CRYPTOCURRENCY_W	1.029474	2.029481	2.472825	0.0014
PRICE_OIL_DUNIA_X4_ VELOCITY_OF_CRYPTOCURRENCY_W	1.048211	0.626261	0.726421	0.4255
PRICE_BATU_BARA_X5_ VELOCITY_OF_CRYPTOCURRENCY_W	0.743216	2.048272	3.402842	0.0000
PRICE_GOLD_DUNIA_X6_ VELOCITY_OF_CRYPTOCURRENCY_W	0.973263	1.042811	1.764272	0.2498

Joint Result Moderating Effect

BETA_CRYPTOCURRENCY_X1_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.013939	2.041384	1.049393	0.6331
LEVEL_TRIATE_X2_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.743164	1.014384	2.039399	0.0025
EXCHANGE_EYE_MONEY_X3_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.041938	0.351723	2.841293	0.0008

PRICE_OIL_WORLD_X4_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	0.636421	2.417390	1.031893	0.4133
PRICE_BATU_BARA_X5_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	2.427330	1.043938	3.134636	0.0000
PRICE_GOLD_DUNIA_X6_ INFLATION_Z_ VELOCITY_OF_CRYPTOCURRENCY_W	1.903877	1.041381	1.484346	0.4184

R-squared	0.641242	Mean dependent var	8.413422
Adjusted R-squared	0.590921	SD dependent var	11.424222
SE of regression	17.042922	Sum squared resid	4.192829
F-statistics	7.094813	Durbin-Watson stat	3.004728
Prob(F-statistic)	0.000109		

Unweighted Statistics

R-squared	0.415362	Mean dependent var	14.09383
Sum squared resid	141523.55	Durbin-Watson stat	2.732853

Source : Output Eviews (Processed Data), 2022

The partial t-test test is to test whether there is a positive effect or to find out the Importance of each variable for my part, in order that it is able to be acknowledged whether or not the prevailing assumptions may be general or rejected.

q. Based on the test utilizing the Eviews 10 application, the tcount value of Beta Cryptocurrency (X1) is known to be 2.634642, or 0.0053.This study's ttable value, df = 520-k (514), is 1.99254 with a significance level of 0.05.Then, it is evident that Return Cryptocurrency (Y) is positively impacted by Beta Cryptocurrency (X1).The significant value of 0.0053 0.05 and the results of the tcount (2.634642) and ttable (1.99254) indicate this.As a result, it is possible to draw the conclusion that the Beta Cryptocurrency variable (X1) has a positive and significant impact on the Cryptocurrency Return (Y). The results of this study are in line with the research conductedIsfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Ronnie Togar Mulia Sirait, Maulana Majied Sumatrani Saragih. (2021), entitled Cryptocurrency Return Assessment Model Based on Negative Risk Factors and Determinant Effect by Velocity of Cryptocurrency Pattern: an Emperical Objective Report from Indonesia Cryptocurrency Exchange.

r. Based on the test results using the Eviews 10 application, it is known that the tcount value of the Interest Rate (X2) is 1.903953 with a significant 0.0011. The ttable value in this study is calculated by df = 520-k (514) is 1.99254 with a significance of 0.05. Then, it can be seen that the Cryptocurrency Return (Y) is positively impacted by the Interest Rate (X2).The significant value of 0.0011 0.05 and the results of the tcount (1.903953) ttable (1.99254) indicate this.As a

result, it is possible to draw the conclusion that Cryptocurrency Return (Y) is unaffected by the Interest Rate variable (X2).Ric Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra, and Wahyuddin Albr (2019) conducted research that is inconsistent with this one.Effect of Conjuncture Fluctuation from the Supercycle Pattern of Commodities:An Experiment on the Relationship Between Cryptocurrency Velocity And Risk Factor in Indonesia.

s. Based on the test results using the Eviews 10 application, it is known that the tcount value of the Currency Exchange (X3) is 3.385232 with a significant 0.0102. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. Then it can be seen that the Currency Exchange (X3) has a positive and significant effect on Cryptocurrency Return (Y). This is indicated by the results of the tcount (3.385232) > ttable (1.99254) and the significant value is 0.0102 < 0.05. So it can be concluded that the Currency Exchange variable (X3) has a significant effect on Cryptocurrency Return (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.
t. Based on the test results using the Eviews 10 application, it is known that the tcount value of the World Oil Price (X4) is 0.745233 with a significant 0.5303. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. Then it can be seen that the World Oil Price (X4) has a positive and significant effect on Cryptocurrency Return (Y). This is indicated by the results of the tcount (0.745233) < ttable (1.99254) and the significant value is 0.5303 > 0.05. So it can be concluded that the variable World Oil Price (X4) has no significant effect on Return Cryptocurrency (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.
u. Based on the test results using the Eviews 10 application, it is known that the tcount value of the Coal Price (X5) is -1.52763 with a significant 0.3722. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that Coal Price (X5) has a negative and insignificant effect on Cryptocurrency Return (Y). This is indicated by the results of the tcount (-1.52763) < ttable (1.99254) and the significant value is 0.3722 > 0.05. So it can be concluded that the Coal Price variable (X5) has no significant effect on Cryptocurrency Return (Y). This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.
v. Based on the test results using the Eviews 10 application, it is known that the tcount value of the World Gold Price (X6) is 2.098527 with a significant 0.0032. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. Then it can be seen that the World Gold Price (X6) has a positive and significant effect on Cryptocurrency Return (Y). This is indicated by the results of the tcount (2.098527) > ttable (1.99254) and the significant value is 0.0032 > 0.05. So it can be concluded that the World Gold Price (X6) variable has a significant effect on Cryptocurrency Return (Y).

This research is in line with research conducted byMuammar Gaddafi, Rico Nur Ilham (2021). The Effect of Risk factor and World Commodity Price in Indonesia Exchange cryptocurrency Return.

w. Based on the test results using the Eviews 10 application, it is known that the tcount value of Inflation (Z) is -1.41234 with a significant 0.2505. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. So it can be seen that Inflation (Z) has a negative and insignificant effect on Cryptocurrency Return (Y). This is indicated by the results of the tcount (-1.41234) < ttable (1.99254) and the significant value is 0.2505 > 0.05. So it can be concluded that the inflation variable (Z) has no significant effect on Cryptocurrency Return (Y). This research is in line with research conducted byRico Nur Ilham, Erlina, Khairah Amalia Fachrudin, Amlys Syahputra Silalahi, Jumadil Saputra (2019). Comparative Analysis of Block Chains and the Supply Chain for the Purpose of Increasing National Revenues Through Virtual Tax Transactions and Replacing Future Money.

x. Based on the test results using the Eviews 10 application, it is known that the tcount value of Velocity of Cryptocurrency (W) is 1.005224 with a significant 0.3124. The ttable value in this study is calculated by df = 520-k (514) which is 1.99254 with a significance of 0.05. Then it can be seen that Velocity of Cryptocurrency (W) has a positive and insignificant effect on Return Cryptocurrency (Y). This is indicated by the results of the tcount (1.005224) < ttable (1.99254) and the significant value is 0.3124 > 0.05. So it can be concluded that the Velocity of Cryptocurrency (W) variable has no significant effect on Cryptocurrency Return (Y). This research is in line with research conducted byIsfenti Sadalia, Nisrul Irawati, Rico Nur Ilham, Abdul Nasser Hasibuan, Mangasih Sinurat, Saharudin. (2021). Effect of Conjuncture Fluctuation from the Supercycle Pattern of Commodities:An Experiment on the Relationship Between Cryptocurrency Velocity And Risk Factor in Indonesia.

3.10 F Test (Simultaneous)

The F test is used to determine whether the independent variables have an effect on the dependent variable simultaneously.

a. Based on the test results using the Eviews 10 application, it is known that the calculated F value is7.094813significantly0.000109. The ftable value in this study calculated by df = 520-k-1 is 2.22 with a significance of 0.05. So it can be seen that Cryptocurrency Beta (X1), Interest Rates (X2), Currency Exchange (X3), World Oil Prices (X4), Coal Prices (X5) and World Gold Prices (X6) have a positive and significant effect simultaneously on Return Cryptocurrency (Y). This is indicated by the results of the tcount (7.094813) > t table (2.22) and significant value0.000109< 0.05. So it can be concluded that the variables Beta Cryptocurrency (X1), Interest Rates (X2), Currency Exchange (X3), World Oil Prices (X4), Coal Prices (X5) and World Gold Prices (X6) simultaneously have a significant effect on Return Cryptocurrency (Y).

3.11 Moderating Effect Test Results

Hypothesis testing in this study using Moderated

Regression*Analysis*(MRA). MRA is a subset of linear multiple regression in which the regression equation includes interaction elements (multiplication of two or more independent variables).The purpose of MRA is to investigate the factors that the relationship between the independent and dependent variables (the moderating variables) can be strengthened or weakened.

a. It is established that positive MRA coefficient for the interaction Cryptocurrency Beta (X1)_Inflation (Z) against Return Cryptocurrency (Y) is 4.039714, with Tcount 4.039714 greater than or equal to 1.99254 and p-value 0.0000 less than or equal to 0.05. This indicates that the variable Inflation (Z) is a moderating variable that influences the relationship between Cryptocurrency Beta (X1) and Return Cryptocurrency (Y).
b. It is established that positive value of the MRA coefficient for the interaction between Interest Rate (X2) and Inflation (Z) against Return Cryptocurrency (Y) is 2.013933, with a Tcount of 2.013933 greater than 1.99254 and a p-value of 0.0022 0.05. This indicates that the variable Inflation (Z) is a moderating variable that influences the relationship between Interest Rate (X2) and Return Cryptocurrency (Y).
c. It is established that interaction Currency Rate (X3)_Inflation (Z) against Return Cryptocurrency (Y) has a positive MRA coefficient value of 1.746128, with Tcount 1.746128 1.99254 and a p-value of 0.2225 > 0.05. This indicates that inflation (Z) is a moderating variable that influences the relationship between Currency Rate (X3) and Return Cryptocurrency (Y).
d. It is established that positive MRA coefficient for the interaction between World Oil Prices (X4)_Inflation (Z) and Return Cryptocurrency (Y) is 0.636212, with Tcount 0.636212 1.99254 and a p-value of 0.4166 > 0.05. This indicates that inflation (Z) is a moderating variable that influences the relationship between World Oil Prices (X4) and Return Cryptocurrency (Y).
e. It is established that positive value of the MRA coefficient for the interaction between Coal Price (X5) and Inflation (Z) against Return Cryptocurrency (Y) is 0.641252, with a Tcount of 0.641252 and a p-value of 0.5011 above 0.05, indicating that Inflation (Z) is a moderating variable that influences the relationship between Coal Price (X5) and Return Cryptocurrency (Y).
f. It is established that positive MRA coefficient for the interaction between World Gold Price (X6) and Inflation (Z) against Return Cryptocurrency (Y) is 2.475163, with Tcount 2.475163 greater than or equal to 1.99254. The p-value for this interaction is 0.0009 0.05, indicating that Inflation (Z) is a moderating variable that influences the relationship between World Gold Price (X6) and Return Cryptocurrency (Y).

3.12 Joint Moderating Effect Test Results

Hypothesis testing in this study using Moderated Regression *Analysis* (MRA).

a. The interaction's MRA coefficient value is known *Cryptocurrency Beta*

(X1)_Velocity of Cryptocurrency (W)toInflation (Z) is positive, i.e1.049393with Tcount1.049393<1.99254and the p-value is 0.6331 > 0.05, this indicates the variable*Velocity of Cryptocurrency*(W)is a moderator influencing factor in the relationship between *Cryptocurrency Beta* (X1) with*Return Cryptocurrency*(Y).

b. The interaction's MRA coefficient value is known Interest Rate (X2)_Velocity of Cryptocurrency (W)toInflation (Z) is positive, i.e2.039399with Tcount2.039399>1.99254and the p-value is 0.0025 < 0.05, this indicates the variable*Velocity of Cryptocurrency*(W)is a moderator influencing factor in the relationship between Interest Rate (X2)with*Return Cryptocurrency*(Y).
c. The interaction's MRA coefficient value is known Currency Rate (X3)_Velocity of Cryptocurrency (W)toInflation (Z) is positive, i.e2.841293with Tcount2.841293>1.99254and the p-value is 0.0008 < 0.05, this indicates the variable*Velocity of Cryptocurrency*(W)is a moderator influencing factor in the relationship between Currency Rate (X3)with*Return Cryptocurrency*(Y).
d. The interaction's MRA coefficient value is known World Oil Prices (X4)_Velocity of Cryptocurrency (W)toInflation (Z) is positive, i.e1.031893with Tcount1.031893<1.99254and the p-value is 0.4133 <0.05, this indicates the variable*Velocity of Cryptocurrency*(W)is a moderator influencing factor in the relationship between World Oil Prices (X4)with*Return Cryptocurrency*(Y).
e. The interaction's MRA coefficient value is known Coal Price (X5)_Velocity of Cryptocurrency (W)toInflation (Z) is positive, i.e3.134636with Tcount3.134636>1.99254and p-value 0.0000 < 0.05 this indicates the variable *Velocity of Cryptocurrency*(W)is a moderator influencing factor in the relationship between Coal Price (X5) with *Return Cryptocurrency*(Y).
f. The interaction's MRA coefficient value is known World Gold Price (X6)_Velocity of Cryptocurrency (W)toInflation (Z) is positive, i.e1.484346with Tcount 1.484346<1.99254and the p-value is 0.4184 > 0.05, this indicates the variable*Velocity of Cryptocurrency*(W) is a moderator influencing factor in the relationship between World Gold Price (X6) with *Return Cryptocurrency*(Y).

4. CONCLUSIONS

The researchers came to the following conclusions after conducting data analysis and having discussions about the preceding chapter:

43. One can deduce that the Beta Cryptocurrency variable (X1) has a positive an important influence on Cryptocurrency Return (Y).
44. One can deduce that the Interest Rate variable (X2) has no significant effect on Cryptocurrency Return (Y).
45. One can deduce that the Currency Exchange variable (X3) has a significant effect on Cryptocurrency Return (Y).
46. One can deduce that the World Oil Price (X4) variable has no significant effect on Cryptocurrency Return (Y).
47. One can deduce that the Coal Price (X5) variable has no significant effect on Cryptocurrency Return (Y).

48. **One can deduce that the World Gold Price (X6) variable has a significant effect on Cryptocurrency Return (Y).**
49. **One can deduce that the inflation variable (Z) has no significant effect on Cryptocurrency Return (Y).**
50. **One can deduce that the Velocity of Cryptocurrency (W) variable has no significant effect on Cryptocurrency Return (Y).**
51. **One can deduce that the Beta Cryptocurrency variables (X1), Interest Rates (X2), Currency Exchange (X3), World Oil Prices (X4), Coal Prices (X5) and World Gold Prices (X6) simultaneously have a significant effect on Return. Cryptocurrency (Y).**
52. **Inflation variable (Z) is a moderator influencing factor in the connection between Beta Cryptocurrency (X1) and Return Cryptocurrency (Y).**
53. **Inflation variable (Z) is a moderator influencing factor in the connection between Interest Rates (X2) and Cryptocurrency Return (Y).**
54. **Inflation variable (Z) is a moderator influencing factor in the connection between Currency Exchange (X3) and Cryptocurrency Return (Y).**
55. **Inflation variable (Z) is a moderator influencing factor in the relationship between World Oil Prices (X4) and Cryptocurrency Return (Y).**
56. **Inflation variable (Z) is a moderator influencing factor in the relationship between Coal Price (X5) and Cryptocurrency Return (Y).**
57. **Inflation variable (Z) is a moderator influencing factor in the relationship between World Gold Price (X6) and Cryptocurrency Return (Y).**
58. **The Velocity of Cryptocurrency (W) variable is a factor that modifies the connection between Beta Cryptocurrency (X1) and Return Cryptocurrency (Y).**
59. **The Velocity of Cryptocurrency (W) variable is a factor that modifies the connection between Interest Rates (X2) and Cryptocurrency Returns (Y).**
60. **The Velocity of Cryptocurrency (W) variable is a factor that modifies the connection between Currency Exchange (X3) and Cryptocurrency Return (Y).**
61. **The Velocity of Cryptocurrency (W) variable is a factor that modifies the connection between World Oil Prices (X4) and Cryptocurrency Returns (Y).**
62. **The Velocity of Cryptocurrency (W) variable is a factor that modifies the connection between Coal Price (X5) and Cryptocurrency Return (Y).**
63. **The Velocity of Cryptocurrency (W) variable is a factor that modifies the connection between World Gold Price (X6) and Cryptocurrency Return (Y).**

5. REFERENCES

Apsara, RH, & Indriani, A. 2017. Analysis of the Effect of Price of Crude Oil, Earnings Per Share, Price to Book Value, Return on Assets, and Debt to

Equity Ratio on Share Prices of Indonesian Stock Exchange-listed Coal Companies (2012-2016). Diponegoro Journal Of Management, 6(4), 1–13.
Asmar, M., Ahmad, Z. 2011. Market microstructure: The black-box's components.Journal of the International Economics and Finance, Vol. 3(1).
Ayem, Sri. 2016. The Impact of Investment Decisions, Profitability, Capital Structure, Dividend Policy, and Firm Value. Journal of Accounting Vol. 4(1).
Falkner, EM, & Hiebl, MR 2015. SME Risk Management:A Comprehensive Analysis of the Available EvidenceThe Risk Finance Journal, Vol. 16(22).
Ho, C., & Hung, C. (2009). Sentiment of investors as information that influences asset pricing.The Journal of Finance and Banking, 33(5), 892-903.
Ilham, RN, Erlina, Fachrudin, KA, Silalahi, AS, Saputra, J., Albr, W., 2019. Utilizing virtual tax transactions for purchasing management, an investigation into the effects that Bitcoin has on a nation's revenue.Journal of Supply Chain Management, International. Vol. 8(6).
Ilham, RN, Erlina, Fachrudin, KA, Silalahi, AS, Saputra, J. 2019. Comparative Analysis of Block Chains and the Supply Chain for the Purpose of Increasing National Revenues Through Future Money and Virtual Tax Transactions.Journal of Supply Chain Management, International. Vol. 8(5).
Ilham, RN, Fachrudin, KA, Pakpahan, EE 2019. The Obstacles Posed by Utilizing Cryptocurrency as a Product in IndonesiaFinance Conference International, Economics and Business.
Ilham, RN, Sadalia, I., Irawati, N., Sinta, Irada. 2022. Al Qalam: Scientific Journal of Religion and Society. Vol. 16(1).
Kaluge, D. (2019). Using macroeconomic fundamentals, multifactor to explain the behavior of sectoral indices on the Indonesian stock exchange.Sustainability and entrepreneurship issues.
Komalasari, YT (2019). Analysis of the Indonesia Stock Exchange's Mining Sector Stock Index Changes. Journal of Business and Management (Jbima), 7(1), 1–17.
Koskei, L. 2017. Listed Financial Institutions' Stock Returns as a Function of Exchange Rate Risk. Research Journal of Finance and Accounting. Vol. 8(3).
Liu, Y., & Tsyvinski, A. 2018. Risks and Returns of Cryptocurrencies. SSRN Electronic Journal.
Lento, GLD, Latif, IN, & Verahastuti, C. 2019. Analysis of Stock Portfolios in Mining Sub-Sector Companies Listed on the Using Capital Asset Pricing Model (Capm) and Arbitrage Pricing Theory (Apt) Indonesia Stock Exchange (IDX). Journal Of Indonesian Science Economic Research, 1(2), 12–19.
Malla, N., & Asianto, A. 2020. The Indonesia Stock Exchange's Mining Sector Stock Price Index Determinant. International Journal Of Academic Research In Accounting, Finance And Management Sciences. Vol. 10-13, 7678.
Mankiw, N, Gregory, 2003, Macroeconomics, Worth Publishers: 271.
Penman, S., & Reggiani, F. 2013. Earnings from buying and book value:Taking into account risk and growth.Analyses of Accounting Research, Vol. 18(4).
Putra, RD, et al. 2013. Using the Capital Asset Pricing Model (CAPM) and the An examination of the selection of stocks for investment: the Reward to Variability Ratio (RVAR) as a factor in stock investment decision-making. Journal of Business Administration. Vol. 1(2).

Sadalia, I., Irawati, N., Ilham, RN, Hasibuan, AN, Sirait, RTM, Saragih, MMS 2021. Model for evaluating cryptocurrency returns based on negative risk factors and the determinant effect of cryptocurrency velocity:an Objective Empirical Study from an Indonesian Cryptocurrency Exchange. The International Journal of Accounting.

Sadalia, I., Irawati, N., Ilham, RN, Hasibuan, AN, Sinurat, M., Saharudin. 2021. Effect of Conjuncture Fluctuation from the Supercycle Pattern of Commodities:An Experiment on the Relationship Between Cryptocurrency Velocity And Risk Factor in Indonesia. The International Conference on Business and Management of Technology. Vol. 202.

Siringoringo, Renniwaty. 2017. Case Study of Conventional Commercial Banks Listed on the IDX from 2012 to 2016: An Examination of the Indonesian Banking Intermediation Function. Journal of Business and Management Inspiration. Vol. 1 (2).

John, Augustine. 2009. Evaluation of the Impact of Agent Interaction on Stock Trading Volatility on the Indonesia Stock Exchange.

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LAPORAN AKHIR

PENELITIAN TALENTA USU

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IDENTIFIKASI DAN KLASIFIKASI JENIS MANGROVE BESERTA ZONA TANAM MANGROVE DENGAN INTERNET OF THINGS DAN ADVANCE MACHINE LEARNING

TIM PENGUSUL

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RINGKASAN

Tanaman mangrove merupakan tanaman yang berguna untuk mencegah intrusi air laut, erosi, dan Abrasi pantai. Tanaman mangrove juga berguna untuk menopang kehidupan masyarakat sekitar yang tinggal di area pesisir pantai. Tanaman mangrove dapat diolah juga menjadi kerajinan lokal yang dapat menghasilkan nilai ekonomi bagi masyarakat sekitar. Seiring makin meningkatnya populasi manusia, kebutuhan akan nilai ekonomipun kian meningkat dengan cukup pesat. Hal ini tidak terkecuali pada masyarakat yang berada di pesisir pantai. Tanaman mangrove terus ditebang juga minimnya kesadaran masyarakat lokal dalam membudidayakan serta kurangnya pengetahuan untuk mengetahui kandungan air yang cocok dalam melakukan budidaya tanaman mangrove. Situasi ini membuat perlu adanya sebuah sistem yang dapat memonitoring dan mengklasifikasi kondisi kandungan dan zona mangrove agar masyarakat dapat menentukan jenis – jenis mangrove yang cocok untuk ditanamkan pada zona-zona yang sudah ditentukan sehingga, resiko kegagalan penanaman mangrove dapat dikurangi. Dalam pennelitian ini, penulis mengembangkan sebuah metode realtime monitoring untuk mengumpulkan data kandungan air zona – zona mangrove dan melakukan klasifikasi terhadap zona-zona yang sudah dikumpulkan datanya apakah zona tersebut cocok untuk ditanami jenis – jenis mangrove tertentu. Adapun kandungan air yang dimonitoring pada penelitian ini adalah kandungan oksigen terlarut dalam air, ORP, pH, suhu air, suhu udara, kelembapan udara, salinitas, dan ketinggian air. Disamping itu platform sistem yang akan dibangun juga memiliki kemampuan klasifikasi dan identifikasi jenis bibit mangrove yang akan di tanam di zona mangrove tersebut menggunakan Advance Machine Learning, dan juga terdapat kecerdasan buatan untuk melakukan klasifikasi zona mangrove tersebut. Secara penelitian hal ini belum pernah dilakukan sebelumnya secara sistem yang besar di dunia, sehingga gap penelitian tentu masih sangat terbuka luas. Disamping itu penelitian ini sangat mendukung Sustainable Development Goal (SDGs) no 14 yaitu Ekosistem Laut. Tujuan dari penelitian ini adalah melakukan zonasi mangrove yang sesuai sehingga tidak terjadi salah tanam di lingkungan penggiat mangrove di Indonesia. Luaran yang ditargetkan dari penelitian ini adalah Jurnal Q1 terindeks Scopus dengan Impact Factor yang tinggi (IF > 2.5).

PRAKATA

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BAB I. PENDAHULUAN

Indonesia memiliki hutan mangrove terluas di dunia, yakni 3.112.989 ha atau ~ 22,6% dari total mangrove dunia yang seluas 13.776.000 ha (Giri et al. 2011). Di Asia sendiri luas hutan mangrove Indonesia berjumlah sekitar 49% dari total hutan mangrove yang diikuti oleh Malaysia (10%) dan Myanmar (9%) (FAO, 2007). Namun demikian, Indonesia juga menyumbang kerusakan hutan mangrove terbesar dibandingkan negara-negara lain. Kementerian kehutanan Republik Indonesia menginformasikan bahwa hutan mangrove Indonesia yang rusak mencapai 57,6% (RLPS, 2001).

Mangrove umumnya ditemukan di sepanjang garis pesisir pantai yang terlindungi di daerah tropis dan sub-tropis dimana mangrove dapat memenuhi fungsi sosio-ekonomi (FAO, 2007). Wilayah pesisir merupakan ekosistem transisi yang dipengaruhi daratan dan lautan, yang mencakup beberapa ekosistem, salah satunya adalah ekosistem hutan mangrove (Bengen 2002). Mangrove adalah ekosistem pepohonan yang dapat hidup di lingkungan berkadar garam tinggi. Ekosistem mangrove termasuk dalam ekosistem pantai yang terdapat pada perairan tropis dan subtropis, serta menjadi penyangga sistem fauna akuatik karena menjadi tempat berasosiasinya sejumlah biota air.

Upaya penanaman mangrove sudah dilakukan beserta sosialisasinya namun, tetap saja budidaya mangrove belum maksimal dikarenakan belum ditemukannya metode yang tepat untuk melakukan klasifikasi dan memonitoring perkembangan mangrove. Hal ini dikarenakan masing-masing mangrove memiliki ciri karakteristik yang berbeda-beda untuk tumbuh di masing-masing zona yang berbeda. Berbagai macam penelitian telah dilakukan untuk memonitoring dan mengklasifikasikan mangrove. Akan tetapi, pengumpulan data masih harus turun ke-lapangan seperti pengumpulkan data ph, salinitas, kedalaman air, suhu kelembapan udara dan kemampuan oksidasi air. Hal ini menyebabkan tingginya biaya operasional dan kurangnya tingkat effisiensi dalam mengumpulkan data. Untuk meminimalisir waktu dan biaya yang dikeluarkan, proses pengukuran sebaiknya dilakukan dengan mengimplementasikan sensor dan teknologi informasi (Lambrou et al. 2014).

Dengan perkembangan teknologi informasi yang sangat pesat, berbagai macam alat sudah dikembangkan untuk memonitor kualitas air (Zhuiykov, 2012). Salah satu alat yang dapat dimanfaatkan adalah arduiono yang dapat digabungkan dengan beberapa sensor air seperti sensor salinitas, sensor ph, sensor Dissolved Oxygen (DO), sensor kelembapan air, sensor suhu air, sensor suhu udara , sensor kelembapan udara, sensor ultrasonic dam GSM Shield maka akan meciptakan sebuah alat yang dapat memonitoring dan mengklasifikasikan tiap-tiap zona mangrove.

Tabel 1. 1 Rencana Target Luaran

No.	Jenis Luaran*	Nama jurnal, Nama Konfrensi, Jenis KI, Nama Produk, TTG, Model, Karya seni, Judul Buku Ajar
	Luaran Wajib	
1.	Artikel di jurnal internasional	1 artikel jurnal pada Jurnal of Ecological Informatics (Q1, IF = 2.5)
2.	Artikel di jurnal nasional	
3.	Hak Kekayaan Internasional	
4.	Artikel di prosiding internasional terindeks bereputasi	
	Luaran tambahan	
1.	Artikel di prosiding internasional	

2.	Artikel di jurnal nasional	
3.	Hak Kekayaan Intelektual	1 HKI Modul Aplikasi Penggunaan Sistem 1 HKI Program Komputer
4.	Produk/TTG/model/karya seni	
5.	Buku Ajar	
6.	MoU/MoA	1 buah MoU dengan Universiti Sains Malaysia

BAB 2. TINJAUAN PUSTAKA

Dalam IOT, pengiriman data menuju server tidak selalu dapat dilakukan secara langsung/realtime. Near real-time adalah dimana kecepatan memproses suatu data itu penting namun pemrosesan tersebut masih dapat dilakukan dalam hitungan menit. Menurut Cristy Wilson (2021) contoh proses dari near real-time adalah sistem operasional operasi inteligen, yang dimana merupakan kombisanasi dari pemrosesan data dan pemrosesan peristiwa lengkap (CEP), CEP melibatkan penggunaan data dari berbagai sumber untuk mendeteksi pola, hal ini berguna untuk mengidentifikasi peluang dalam kumpulan data seperti prospek penjualan serta ancaman penyusupan pada jaringan internet.

Konsentrasi oksigen terlarut dalam batas – batas tertentu juga mengindikasikan adanya perubahan kualitas perairan, semakin rendah konsentrasinya semakin rendah kualitas perairan (Anonim, 1998). Konsentrasi oksigen akan menurunkan kegiatan fisiologis mahluk hidup dalam air. Dalam penelitiannya, (Welch, 1980) menemukan terjadinya penurunan pada nafsu makan, pertumbuhan dan kecepatan berenang ikan pada saat konsentrasi oksigen kurang dari 8 ppm. Oksigen terlarut yang terdapat dalam air laut berasal dari difusi udara, proses fotosintesis fitoplankton dan tumbuhan bentik. Keberadaannya dalam air laut sangat diperlukan untuk berlangsungnya kehidupa mikroorganisme yang hidup dalam perairan yang bersifat aerobik (Susana, 2009).

Arduino adalah pengendali mikro single-board yang bersifat open-source, diturunkan dari wirring platform, dirancang untuk memudahkan pengguna elektronik dalam berbagai bidang. Hardwarenya memiliki prosesor Atmel AVR dan softwarenya memiliki bahasa pemrograman sendiri. Saat ini Arduino sangat populer diseluruh dunia. Arduino Uno menyediakan 20 pin I/O, yang terdiri dari 6 pin input analog dan 14 pin digital input/output. Untuk 6 pin analog sendiri bias juga difungsikan sebagai output digital. Untuk mengubah pin analog analog menjadi digital cukup mengubah konfigurasi pin pada program. Dalam board kita bias melihat pin digital dengan keterangan 0-13. Sedangkan pin digital pada board memiliki keterangan 0-5. Untuk mengubah output analog menjadi output digital.

Untuk sensor dalam air, digunakan beberapa sensor diantaranya DS18S20 untuk mengukur suhu air, Analog PH Meter Pro untuk mengukur pH air, Dissolved Oxygen Sensor Kit untuk mengukur DO air, dht11 untuk mengukur suhu dan kelembapan udara, ORP meter untuk mengukur kadar ORP air, Salinity Sensor untuk mengukur kadar kandungan garam dalam air dan XL-Maxsonar-EZ3 untuk mengukur kedalaman air pasang surut.

Beberapa penelitian mengenai Real – Time Monitoring sudah pernah dilakukan, diantaranya oleh Choughule et al. (2017) melakukan penelitian tentang Real Time Monitoring untuk memantau kadar kandungan pada air disetiap tempat (danau, sawah dsb) dengan menggunakan teknologi IOT dimana data yang telah dikumpulkan oleh sensor akan langsung diupload menuju cloud server sehingga data – data tersebut dapat dilihat oleh semua orang melalui webbase ataupun aplikasi handphone.

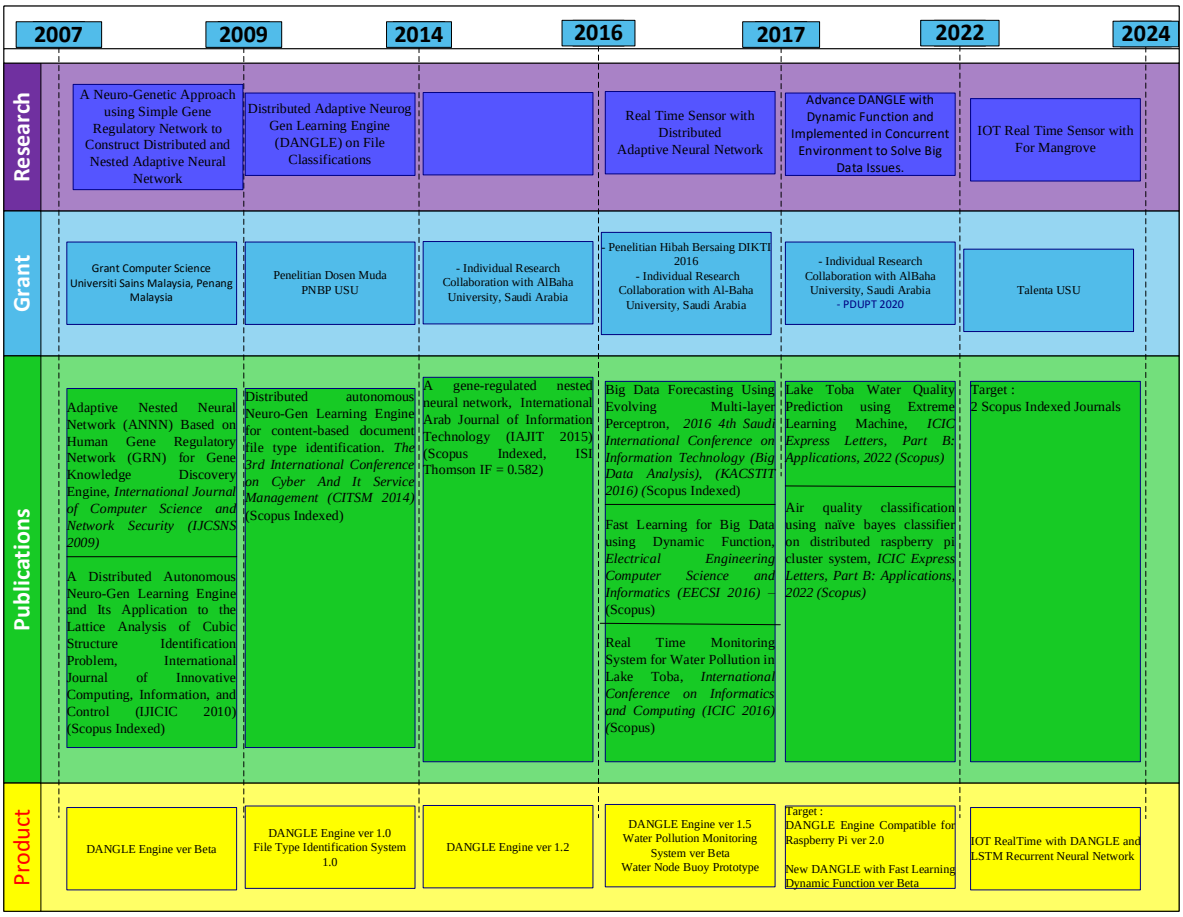
Penelitian selanjutnya dilakukan oleh Lasminto et al. (2016), mengenai pasang surut air laut dengan menggunakan sensor tekanan, sensor pelampung dan sensor ultrasonic. Tujuan dari penelitian ini adalah membuat alat ukur untuk memonitoring perubahan elevasi permukaan air laut secara real time. Penelitian selanjutnya dilakukan oleh Atmanathan (2017), mengenai polusi kandungan air di Danau Toba. Tujuan dari penelitian ini adalah memantau tingkat polusi air pada Danau Toba dengan mengukur tingkat oksigen terlarut pada air, tingkat pH air, tingkat suhu air, tingkat ORP air, tingkat suhu udara dan kelembapan yang terkandung di dalam air secara real time.

Penelitian selanjutnya dilakukan oleh (Atmanatha et al., 2017). Penelitian tersebut menggunakan wireless sensor network untuk melakukan real time monitoring di Danau Toba. Adapun kandungan air yang dimonitoring adalah pH, suhu udara, suhu air, kelembapan udara, dan kandungan oksigen terlarut didalam air (dissolved oxygen). Metode yang diterapkan pada penelitian tersebut adalah dengan menggunakan raspberry PI 2 yang sudah ditautlan dengan modul GSM shield sehingga data yang dikumpulkan oleh sensor dapat langsung dikirim menuju hosting dan dapat langsung dimonitoring dengan menggunakan layar komputer. Hasil dari penelitian tersebut adalah data – data yang dikumpulkan dengan menggunakan Arduino uno, GSM Shield, dan raspberry PI2 dapat diolah untuk pengambilan keputusan dimasa depan mengenai tingkat kualitas air yang ada di Danau Toba.

Dari semua penelitian yang dilakukan, belum ada yang menggunakan real time monitoring network utntuk memantau kualitas air mangrove. Penelitian yang dilakukan oleh (Atmanathan et al., 2017) sudah cukup baik. Namun, kendala yang dihadapi adalah power supply yang tidak dapat diisi ulang secara bersamaan. Hal ini tentunya menyebabkan monitoring dan pengumpulan data tidak dapat dilakukan secara berkala terus menerus.

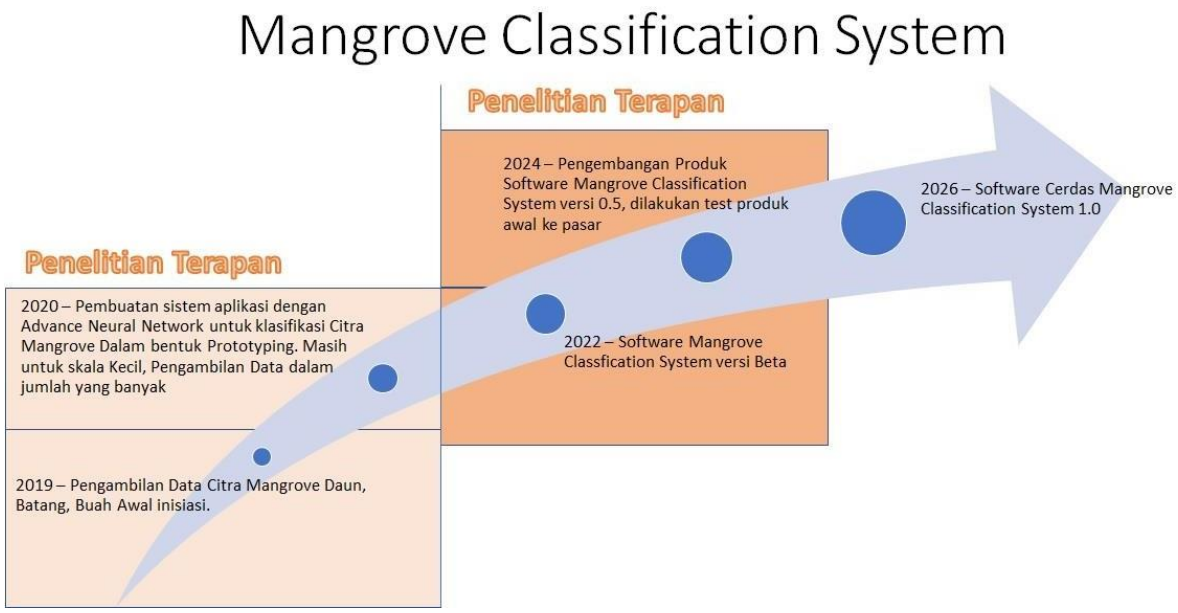
Khusus dari peneliti sendiri, maka Penelitian berawal dari tahun 2007 – 2009 dimana topik penelitian nya adalah Pendekatan neuro genetik menggunakan simple gene regulatory network untuk membangun distrusted dan nested adaptive neural network, dengan skema penelitian dari Universiti Sains Malaysia, Penang. Pada penelitian ini menghasilkan 2 publikasi yaitu Adaptive Nested Neural Network (ANNN) Based on Human Gene Regulatory Network (GRN) for Gene Knowledge Discovery Engine, International Journal of Computer Science and Network Security (IJCSNS 2009) dan A Distributed Autonomous Neuro-Gen Learning Engine and Its Application to the Lattice Analysis of Cubic Structure Identification Problem, International Journal of Innovative Computing, Information, and Control (IJICIC 2010) (Scopus Indexed).

Penelitian dilanjutkan pada tahun 2014, yaitu DANGLE untuk mengklasifikasi file dan menghasilkan satu conference paper terindex scopus yaitu Distributed autonomous Neuro-Gen Learning Engine for content-based document file type identification. The 3rd International Conference on Cyber and It Service Management (CITSM 2014) (Scopus Indexed). Kemudian pada tahun 2015 menghasilkan 1 journal internasional berfaktor dampak yaitu A gene-regulated nested neural network, International Arab Journal of Information Technology (IAJIT 2015) (Scopus Indexed, ISI Thomson IF = 0.582), dan terakhir pada tahun 2016 menghasilkan 3 luaran yaitu Big Data Forecasting Using Evolving Multi-layer Perceptron, 2016 4th Saudi International Conference on Information Technology (Big Data Analysis), (KACSTIT 2016) (Scopus Indexed), Fast Learning for Big Data using Dynamic Function, Electrical Engineering Computer Science and Informatics (EECSI 2016) – indexed by Scopus, dan Real Time Monitoring System for Water Pollution in Lake Toba, International Conference on Informatics and Computing (ICIC 2016) – indexed by Scopus. Pada tahun 2022 juga sudah mendapatkan 2 artikel jurnal terindex Scopus yaitu melalui judul Lake Toba Water Quality Prediction using Extreme Learning Machine, ICIC Express Letters, Part B: Applications, 2022 (Scopus) dan Air quality classification using naïve bayes classifier on distributed raspberry pi cluster system, ICIC Express Letters, Part B: Applications, 2022 (Scopus).



Gambar 2. 1 Road Map Penelitian

Sedangkan secara sistem berikut adalah roadmap secara sistem



Gambar 2. 2 Road Map Sistem Klasifikasi Mangrove

Saat ini penelitian masih dalam tahap kedua, dimana tahap pertama sudah dilakukan yaitu mengumpulkan data awal citra mangrove untuk uji coba inisiasi kemungkinan awal saja. Selanjutnya penelitian terapan ini akan menjadi awal berkembangnya produk software klasifikasi mangrove yang cerdas dan dapat dilempar ke pasar pada tahun 2026.

BAB 3. METODE PENELITIAN

3.1. Distributed Adaptive Neural Network

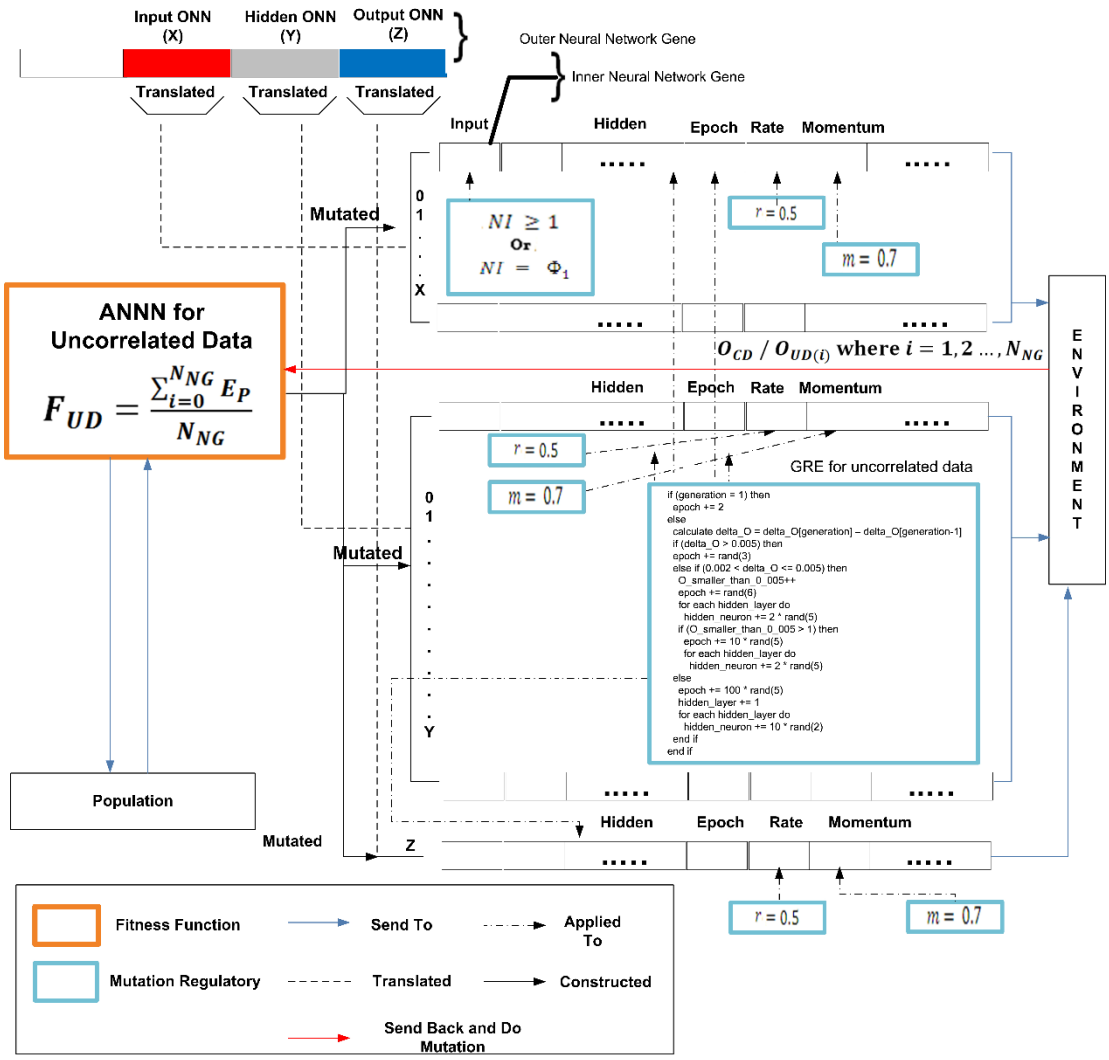
Distributed Adaptive Neuro Gen Learning Engine yang mana disebut sebagai *DANGLE* terdiri atas dua komponen utama, yaitu: komponen regulasi gen yang disebut dengan *Gene Regulatory Engine* (GRE) dan komponen jaringan neural yang disebut dengan *Distributed Adaptive Neural Network* (*DANN*) (Pasha, 2010)(Aaron, 2014). *GRE* memiliki tugas untuk melakukan regulasi, konstruksi, serta melatih seluruh jaringan yang terdapat pada *DANN*. *DANN* terdiri atas beberapa jaringan saraf tiruan yang terhubung pada *GRE* secara distributif dan adaptif, dimana setiap jaringan saraf tiruan pada *DANN* akan memiliki gen masing-masing yang diatur oleh *GRE*. *DANN* akan mengkonstruksikan jaringan saraf tiruan sesuai dengan gen yang dimiliki, kemudian hasil output dari *DANN* akan dikembalikan pada *GRE* untuk pengembangan gen selanjutnya.

3.1.1. Gene Regulatory Engine

Gene Regulatory Engine (*GRE*) merupakan sebuah regulator gen sederhana yang diinspirasi oleh interaksi gen satu ke satu dari *Gene Regulatory Network* pada bidang biologi (Rahmat, 2008). *GRE* digunakan untuk mengendalikan, memutasi, serta melatih gen sebelum gen dikirimkan pada *DANN* (Rahmat, 2015). Secara sederhana, GRE mengimplementasikan sebuah *Genetic Algorithm* (*GA*) tanpa proses *crossover* dan *parent selection*, serta inisialisasi populasi secara acak juga tidak terjadi pada *GRE* (Hasibuan, 2009). Secara spesifik diagram lengkap dari model *GRE* dapat dilihat pada gamber 2.9, dimana ada dapat dilihat seluruh komponen yang terdapat pada *GRE*.

3.1.2. Distributed Adaptive Neural Network

Distributed Adaptive Neural Network (*DANN*) dapat juga disebut sebagai sebuah *Adaptive Nested Neural Network* (*ANNN*) *for Uncorrelated Data. DANN* didesain untuk menyelesaikan permasalahan dengan setiap partisi data tidak mempunyai korelasi atau hubungan dengan partisi data yang lain (Rahmat, 2008). Secara konseptual, *DANN* menggunakan beberapa jaringan saraf tiruan dan membagi beban kerja pada setiap jaringan saraf tiruan, dibandingkan dengan membiarkan sebuah jaringan saraf tiruan yang besar dan kompleks memproses seluruh data yang ada (Pasha, 2010). *DANN* diaplikasikan untuk mengurangi kompleksitas dari data serta permasalahan, seperti permasalahan x-ray cubic structure (Pasha, 2010), identifikasi file berdasarkan komponen (Aaron, 2014). Setiap agen pada *DANN* dimodelkan untuk menerima input yang berbeda, kemudian setiap output dari setiap agen akan dikembalikan pada *GRE* untuk digunakan sebagai parameter pada proses mutasi.



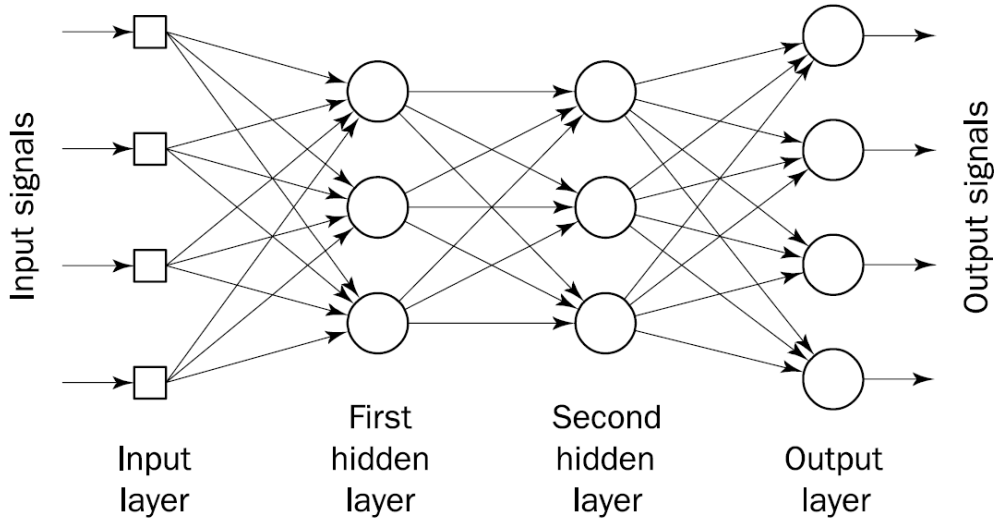
Gambar 3. 1 Diagram lengkap model *GRE* (Rahmat, 2008)

3.2. Artificial Neural Network

Artificial Neural Network atau jaringan saraf tiruan dapat didefinisikan sebagai sebuah model logika yang berdasarkan otak manusia. Sebuah jaringan saraf tiruan memodelkan otak dengan menggunakan sejumlah neuron yang sederhana dan saling terkoneksi dengan sebuah nilai bobot yang meneruskan signal dari satu neuron menuju neuron lainnya (Negnevitsky, 2005). Setiap neuron akan menerima sejumlah input melalui hubungannya, kemudian neuron tersebut akan menghasilkan satu output, sesuai dengan nilai bobot yang pada hubungan tersebut, kemudian diteruskan kembali ke neuron yang lain (Watts, 2006). Setiap neuron pada jaringan saraf tiruan akan tersusun dalam beberapa *layer* atau lapisan. Secara umum, sebuah jaringan saraf tiruan terdiri atas tiga *layer*, yakni: *input layer* yang merupakan node-node yang menerima signal input, *middle layer* atau sering disebut juga dengan *hidden layer* yang terdiri atas node yang menghubungkan node pada *input layer* menuju ke *output layer*, dan *output layer* yang merupakan node-node yang menghasilkan signal output (Kasabov, 2007).

3.3. Deep Learning

Deep Neural Network merupakan sebuah jaringan saraf tiruan (*Neural Network*) yang memiliki lebih dari satu *hidden layer*, sehingga *DNN* juga dikenal sebagai *multilayer perceptron*. Output pada sebuah *multilayer perceptron* dapat ditentukan menggunakan rumus fungsi aktivasi *sigmoid function*. Arsitektur dari sebuah *multilayer perceptron* dengan dua *hidden layer* dapat dilihat pada Gambar 2.5 (Negnetvisky, 2005).



Gambar 3. 2 Arsitektur *Multilayer Perceptron* dengan Dua *Hidden Layer* (Negnevitsky, 2005)

Deep Neural Network juga menggunakan arsitektur *deep* (*deep architectures*). Arsitektur *deep* terdiri atas beberapa tingkat operasi *non-linear*, seperti jaringan saraf tiruan dengan banyak *hidden layer* atau dalam sebuah rumusan yang menggunakan banyak sub-rumusan (Bengio, 2009).

Deng & Yu (2014) mendefenisikan *DNN* adalah generasi baru dari jaringan saraf tiruan yang menggunakan konsep *deep learning*. *Deep learning* adalah sebuah kumpulan teknik pembelajaran mesin yang memanfaatkan banyak lapisan pemrosesan informasi linear untuk ekstraksi fitur dan transformasi yang *supervised* dan *unsupervised*, serta untuk analisis pola dan klasifikasi. *Deep learning* terbagi menjadi tiga kategori, yakni:

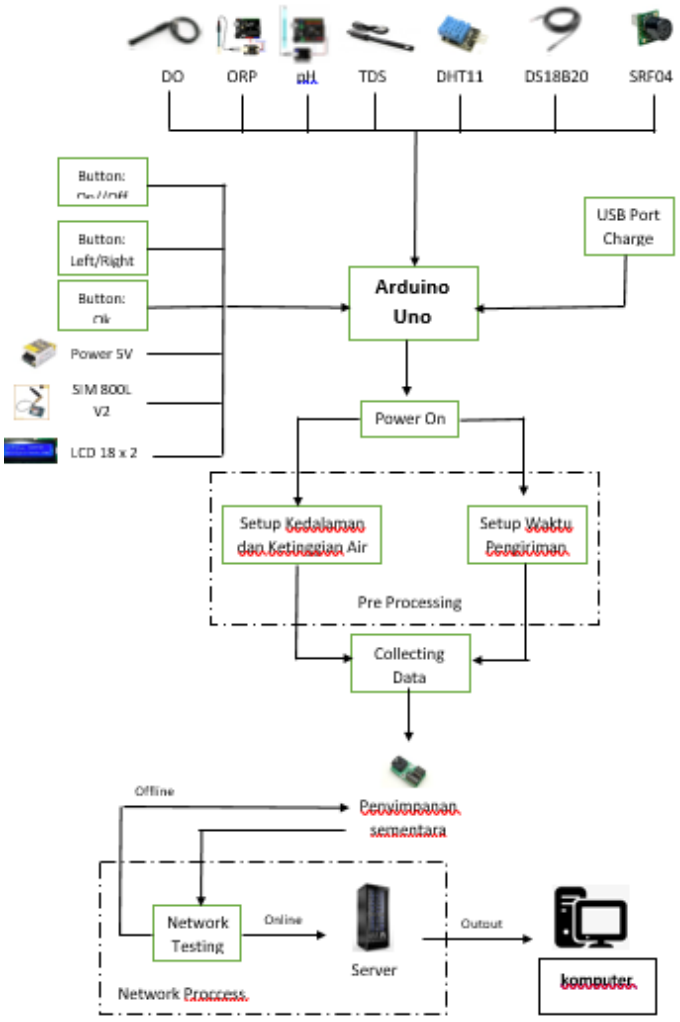
1. *Deep networks* untuk pembelajaran *unsupervised* atau generatif, bertujuan untuk mendapatkan korelasi atau keterkaitan antara data yang dapat diobservasi untuk analisis pola pada saat informasi tentang hasil yang seharusnya didapatkan tidak ada.
2. *Deep networks* untuk pembelajaran *supervised*, bertujuan menyediakan kemampuan untuk membedakan klasifikasi pola secara langsung, dilakukan dengan mengkarakteristik distribusi kelas untuk data.
3. *Hybrid deep networks*, memiliki tujuan sebagai pembeda dimana secara signifikan dibantu dengan hasil yang didapatkan dari *deep network* untuk pembelajaran *unsupervised*.

Heaton (2015) mendefinisikan d*eep learning* adalah sebuah pengembangan baru dalam bidang pemrograman jaringan saraf tiruan yang memberikan cara untuk melatih *DNN*. Jaringan saraf tiruan dengan lebih dari dua lapisan (*layer*) disebut sebagai *deep*. Kemampuan untuk membuat *DNN* telah muncul sejak 1943 dimana Pitts mengenalkan *multilayer perceptron*. Jaringan saraf

tiruan pada awalnya belum dapat dilatih secara efektif hingga Hinton berhasil menjadi peneliti pertama yang melatih jaringan saraf tiruan yang rumit pada tahun 1984.

3.4 Metodology dan Arsitektur Umum Sistem

Berikut adalah rancangan umum / arsitektur umum sistem IoT yang akan dibangun.

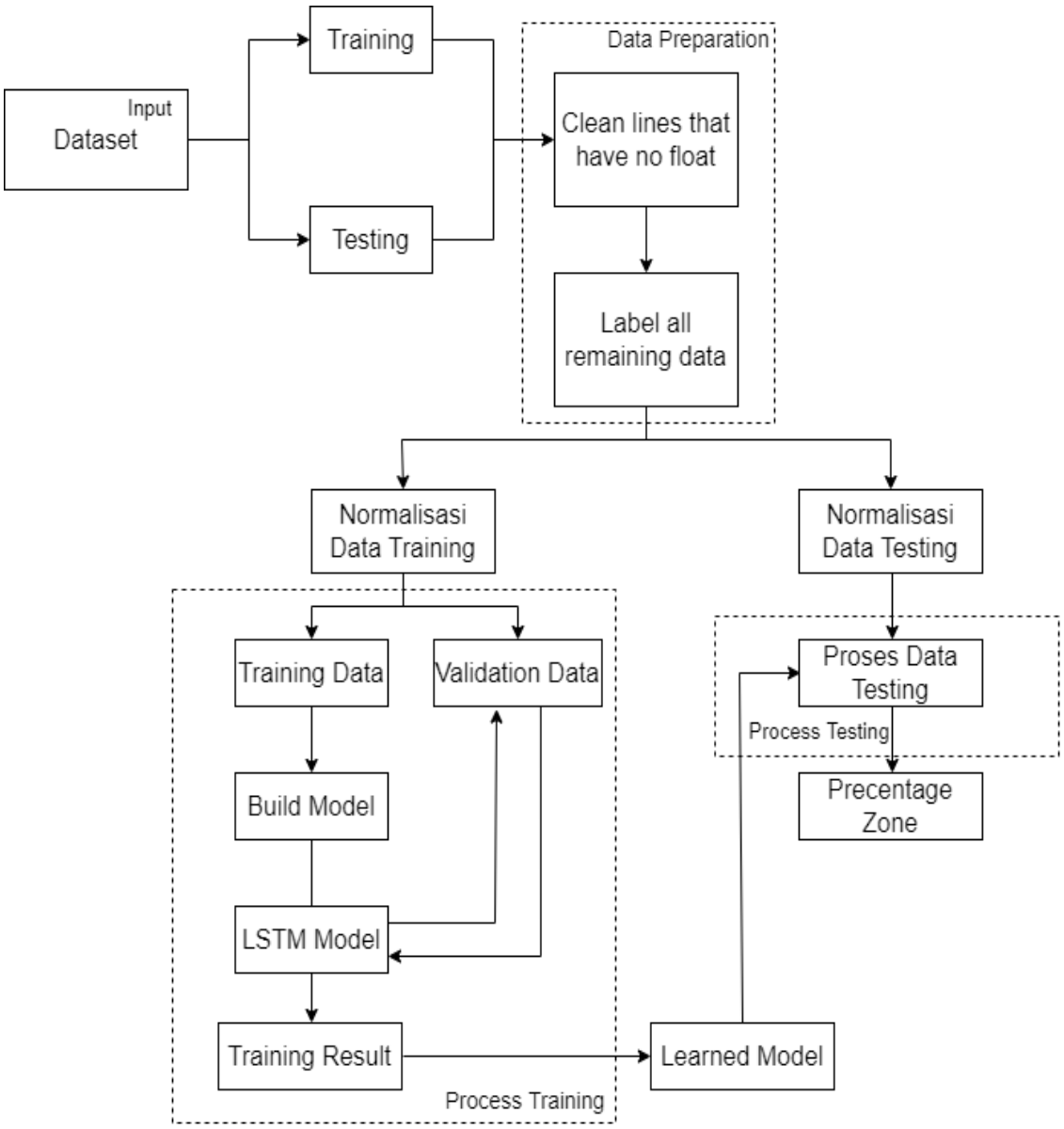


Gambar 3. 3 Arsitektur Umum Sistem IoT

Teknik pengumpulan data adalah menggunakan internet of things berupa sensor-sensor air seperti sensor kandungan oksigen terlarut dalam air, ORP, pH, suhu air, suhu udara, kelembapan udara, salinitas, dan ketinggian air. Kemudian data juga diambil dari gambar-gambar bibit mangrove dengan berbagai jenis yang akan terkoneksi kedalam sistem klasifikasi dengan Artificial Intelligence di dalam nya sehingga memudahkan petani melakukan zona matching ketika dilakukan penanaman mangrove tersebut.

Tahap awal yang dilakukan adalah mempersiapkan input berupa dataset mangrove yang terdiri dari 10 atribut yaitu ketinggian air, suhu air, kelembapan udara, tds, orp, do, pH, datetime, dan lokasi yang berjumlah 2342 baris yang nantinya akan dibersihkan melalui proses pre-processing. Data preparation atau bisa disebut data preprocessing adalah proses normaliasi yang dilakukan terhadap dataset agar sesuai dengan nilai yang telah ditetapkan. Dalam penelitian ini, tahap data preparation dibagi menjadi 2 tahap antara lain, data cleaning dan data labeling. Pada data cleaning dilakukan proses seleksi data untuk memeriksa data yang berulang serta menghilangkan dan memperbaiki instance atau feature yang salah pada dataset. Data yang

salah akan dibuang karena mampu mengurangi tingkat akurasi. dataset akan dimuat terlebih dahulu, kemudian akan dilakukan pengecekan setiap baris apakah berupa angka desimal (float) atau tidak secara berulang sebanyak baris yang ada pada dataset. Apabila terdapat sebuah data pada baris tertentu yang kosong maka baris tersebut akan diisi dengan angka 0. Begitu seterusnya sampai baris terakhir data. Selanjutnya paramater data yang tidak akan digunakan dalam penelitian akan di delete seperti ketingian air, suhu udara, kelembapan udara, tds, dan orp. Sehingga hanya menyisakan parameter pH, suhu air dan DO. Proses terakhir dari data preparation yaitu data labeling, dimana pelabelan data dilakukan untuk menentukan output berdasarkan feature yang digunakan yaitu suhu udara, pH dan Dissolved Oxygen (DO).Setelah proses data preparation selesai maka file akan disimpan kedalam CSV baru yang terdiri dari 4 kolom, yaitu pH, suhu air, DO dan label.



Gambar 3. 4 Arsitektur Umum Advance Machine Learning

Kemudian proses *training* akan di jalankan, dimana model akan dilatih menggunakan data *training* yang telah disediakan. Data latih akan diproses dengan permodelan yang sudah dibuat yaitu lstm model. Dimana pada lstm model data akan masuk ke *neuron* melalui *hidden layer*. Pada satu *neuron* data yang terletak pada *cell state* akan melalui *forget gate* untuk ditentukan apakah data tersebut akan disimpan atau dibuang, dimana penentuannya ditentukan melalui

fungsi aktivasi dan dua kondisi. Apabila hasilnya berupa 0 maka data pada *cell state* akan dibuang dan apabila hasilnya 1 maka data akan pertahankan. Selanjutnya data pada *cell state* akan dilanjutkan melalui *input gate* yang mana *input gate* ini memiliki dua fungsi yaitu untuk *update* atau menambahkan data pada *cell state.* Setelah imodifikasi dan ditambahkan diperbaharui data pada *cell state* akan dilanjutkan mealui *output gate*. Dimana data pada *cell state* akan diubah untuk disampaikan pada *neuron* selanjutnya melalui *hidden layer* selanjutnya dan akan terus berlangsung sebanyak nilai *epoch* yaitu 10. Dalam penelitian ini, data yang tersimpam di dalam *cell state* berupa, *pH,* suhu, *do* dan label dimana data inilah yang akan berpengaruh pada pengidentifikasian mangrove. Bobot dan bias akan terus diperbaharui untuk memperoleh model yang sesuai. Setelah satu literasi *process training* selesai, maka dilakukan proses validasi untuk mengetahui kinerja model hasil *training.*

Lokasi penelitian adalah di Laboratorium Multimedia dan Image Processing, Fasilkom-TI, USU, rencana kegiatan di hutan mangrove adalah di hutan mangrove Desa Pulau Sembilan, Kabupaten Langkat.

Untuk parameter yang akan diamati adalah : terdiiri dari parameter :

1. Ph, Suhu air, Dyssolve Oxygen, ketinggian air, dll
2. Citra Bibit Mangrove,
3. Accuracy, training loss, epoch, softmax variable, adamax variable , f1-Score, Precision, dan Recall

Susunan Organisasi Tim Pengusul dan Pembagian Tugas

No.	Nama/NIDN/NIP	Fakultas/Unit	Bidang Ilmu	Uraian Tugas
1	Romi Fadillah Rahmat	Fakultas Ilmu Komputer dan Teknologi Informasi – Universitas Sumatera Utara	Kecerdasan Buatan, Internet of Things, Machine Learning	Implementasi sistem, coding, debugging, analysis, testing verifikasi sistem secara keseluruhan. Membuat luaran jurnal ilmiah yang sesuai. Menyusun konseptualisasi sistem yang akan di bangun.
2	Onrizal	Fakultas Kehutanan – Universitas Sumatera Utara	Mangrove Morphology and Zoning	Menentukan tempat pengambilan data, fasilitasi jenis mangrove, verifikasi sistem setelah sistem bekerja dengan baik
3	Sarah Purnamawati	Fakultas Ilmu Komputer dan Teknologi Informasi – Universitas Sumatera Utara	Design Interface, Database system	Membuat desain interface yang sesuai dan mudah di gunakan, kemudian melakukan desain database dan cara penghantaran data serta jaringan yang sesuai.
4	Nur Intan Ruhaina Ruhaiyem	School of Computer Science –	Image Processing dan	Menyediakan laboratorium untuk uji coba menggunakan

		Universiti Sains Malaysia	Artificial Intelligence	advance machine learning. Menentukan spesifikasi sistem serta basis data dan teknologi yang akan di gunakan dalam penelitian ini. Menentukan methodology pemprosesan citra yang sesuai

BAB 4. HASIL DAN PEMBAHASAN

Setelah sistem seudah selesai dibangun, maka alat akan mulai mengumpulkan data dan mengirim data-data tersebut menuju *cloud server* sehingga sistem juga dapat melakukan klasifikasi tanaman mangrove berdasarkan kandungan air yang ada.

Proses pengambilan data dilakukan selama kurang lebih 3 jam/titik zona lokasi dengan pengiriman 1 data / 3 menit, maka setiap zona akan menghasilkan sekitar 150 – 250 data. Jika data – data tersebut dijumlahkan, maka total data yang didapat sebanyak lebih kurang 2.300 data kandungan air zona mangrove.

Hasil Implementasi Monitoring Seaward Zone

Kandungan air yang terdapat pada *seaward zone* yang ada dipulau Sembilan tidak mengalami perubahan yang terlalu signifikan. Kandungan salinitas yang ada pada zona tersebut berkisar sekitar 500 ppm – 700 ppm.

Tabel 4. 1 Monitoring zona *seaward*

	Ketinggian Air	Suhu Air	Suhu Udara	Kelembapan Udara	ORP	pH	Salinitas (TDS)	DO
Titik 1	138 cm	29.94	27.00	43.00%	320.18 Mv	8.65	715.80 ppm	22.42 ppm
Titik 2	142 cm	30.12	29.00	40.00%	294.46 Mv	6.02	616.75 ppm	22.41 ppm
Titik 3	152 cm	29.87	30.00	36.00%	242.42 Mv	5.06	721.64 ppm	21.73 ppm
Titik 4	159 cm	29.94	30.00	32.00%	244.76 Mv	5.32	535.99 ppm	22.42 ppm
Titik 5	163 cm	29.81	30.00	27.00%	428.30 Mv	6.80	568.11 ppm	22.41 ppm

Hasil Implementasi Monitoring Seaward Zone

Kandungan air yang berada pada *middle zone* air mangrove kandungan air tidak mengalami perubahan yang terlalu signifkan. Setiap titik diberi jarak 10 meter dengan titik lainnya. Titik – titik tersebut disebarkan ke sepanjang garis pantai.

Tabel 4. 2 Monitoring Zona *MidleWard*

	Ketinggian Air	Suhu Air	Suhu Udara	Kelembapan Udara	ORP	pH	Salinitas (TDS)	DO
Titik 1	55 cm	29.62	28.00	34.00%	131.94 Mv	8.61	518.22 ppm	28.01 ppm
Titik 2	63cm	29.37	28.00	34.00%	115.23 Mv	7.81	559.97 ppm	28,42 ppm
Titik 3	58 cm	29.87	28.00	33.00%	98.02 Mv	7.90	521.30 ppm	27.28 ppm
Titik 4	55 cm	30.06	28.00	33.00%	120.12 Mv	8.76	553.47 ppm	25.07 ppm
Titik 5	60 cm	30.00	28.00	36.00%	139.26 Mv	8.37	555.47 ppm	25.32 ppm
Titik 6	64 cm	29.81	29.00	36.00%	159.05 Mv	8.50	516.51 ppm	26.95 ppm
Titik 7	59 cm	30.06	29.00	35.00%	102.23 Mv	8.82	535.67 ppm	27.49 ppm
Titik 8	57 cm	29.87	28.00	36.00%	121.92 Mv	9.44	512.41 ppm	26.56 ppm
Titik 9	63 cm	30.12	29.00	35.00%	123.33 Mv	9.06	520.95 ppm	25,38 ppm
Titik 10	69 cm	30.06	29.00	34.00%	125.51 Mv	8.84	521.98 ppm	25.76 ppm

Hasil Implementasi Zona Landward

Kandungan air zona manrove pada zona ini memiliki tingkat salinitas yang cukup tinggi.

Tabel 4. 3 Monitoring Zona *LandWard*

	Ketinggian Air	Suhu Air	Suhu Udara	Kelembapan Udara	ORP	pH	Salinitas(TDS)	DO
Titik 1	29 cm	29.56	27.00	38.00%	132.71 Mv	11.67	517.54 ppm	29.01 ppm
Titik 2	32 cm	29.00	28.00	39.00%	151.60 Mv	10.41	520.27 ppm	28.96 ppm
Titik 3	27 cm	28.94	28.00	39.00%	154.94 Mv	11.76	520.95 ppm	28.05 ppm
Titik 4	35 cm	29.31	28.00	36.00%	113.95 Mv	9.48	511.39 ppm	27.82 ppm

Hasil Klasifikasi

Setelah data-data zona mangrove dikumpulkan, maka sistem akan memberikan kondisi serta klasifikasi zona berdasarkan baik buruknya kandungan air tersebut. Klasifikasi dari kandungan air zona mangrove dapat dilihat pada gambar 4.4, 4.5, dan 4.6.

Tabel 4. 4 Hasil Klasifikasi *Seaward Zone*

No	Nama Zona	Lokasi	Ketinggian Air	pH	Suhu Air	Suhu Udara	TDS	ORP	DO
15	Monitoring Zona Seaward	Seaward Zone titik 1	143 (Baik)	8 (Buruk)	27 (Buruk)	26 (Baik)	713 (Buruk)	320 (Baik)	27 (Buruk)
16	Monitoring Zona Seaward	Seaward Zone titik 2	98 (Baik)	6 (Buruk)	24 (Buruk)	28 (Baik)	511 (Buruk)	280 (Baik)	19 (Baik)
17	Monitoring Zona Seaward	Seaward Zone titik 3	99 (Baik)	5 (Buruk)	29 (Baik)	26 (Baik)	515 (Buruk)	227 (Buruk)	23 (Buruk)
18	Monitoring Zona Seaward	Seaward Zone titik 4	134 (Baik)	5 (Buruk)	27 (Buruk)	25 (Buruk)	634 (Buruk)	262 (Baik)	23 (Buruk)
19	Monitoring Zona Seaward	Seaward Zone titik 5	130 (Baik)	7 (Baik)	28 (Buruk)	29 (Buruk)	560 (Buruk)	372 (Buruk)	21 (Baik)

Data menujukkan bawah seluruh titik yang ada pada zona *seaward* di dipulau Sembilan mengalami kondisi air yang buruk.

No	Nama Zona	Lokasi	Ketinggian Air	pH	Suhu Air	Suhu Udara	TDS	ORP	DO
1	Monitoring Middle Zone	Mid Zone Titik 1	106 (Baik)	8 (Baik)	27 (Buruk)	27 (Baik)	517 (Buruk)	132 (Buruk)	25 (Buruk)
2	Monitoring Middle Zone	Mid Zone Titik 2	131 (Baik)	7 (Baik)	28 (Buruk)	24 (Buruk)	567 (Buruk)	158 (Buruk)	19 (Baik)
3	Monitoring Middle Zone	Mid Zone Titik 3	131 (Baik)	7.89 (Baik)	29.89 (Baik)	28.04 (Buruk)	521.63 (Buruk)	98.54 (Buruk)	22.43 (Buruk)
4	Monitoring Middle Zone	Mid Zone Titik 4	114 (Baik)	8.71 (Baik)	30.17 (Buruk)	29.16 (Buruk)	555.59 (Buruk)	120.13 (Buruk)	22.65 (Buruk)
5	Monitoring Middle Zone	Mid Zone Titik 5	124 (Baik)	8.42 (Baik)	30.12 (Buruk)	28.64 (Buruk)	555.59 (Buruk)	139.55 (Buruk)	22.48 (Buruk)
6	Monitoring Middle Zone	Mid Zone Titik 6	137 (Baik)	8.57 (Baik)	29.84 (Baik)	29.03 (Buruk)	516.55 (Buruk)	159.18 (Buruk)	22.67 (Buruk)
7	Monitoring Middle Zone	Mid Zone Titik 7	125 (Baik)	8.89 (Baik)	30.18 (Buruk)	29.14 (Buruk)	535.62 (Buruk)	102.15 (Buruk)	22.48 (Buruk)
8	Monitoring Middle Zone	Mid Zone Titik 8	131 (Baik)	9.59 (Buruk)	29.89 (Baik)	28.08 (Buruk)	512.64 (Buruk)	121.87 (Buruk)	22.69 (Buruk)
9	Monitoring Middle Zone	Mid Zone Titik 9	132 (Baik)	9.13 (Buruk)	30.15 (Buruk)	29.12 (Buruk)	521.17 (Buruk)	123.65 (Buruk)	22.41 (Buruk)
10	Monitoring Middle Zone	Mid Zone Titik 10	125 (Baik)	8.81 (Baik)	30.18 (Buruk)	29.13 (Buruk)	521.99 (Buruk)	125.57 (Buruk)	22.65 (Buruk)

Tabel 4. 5 Hasil Klasifikasi *Midle Zone*

Data menunjukkan bahwa titik yang dimonitoring lebih banyak mengalami kondisi parameter dengan kualitas air yang buruk daripada parameter dengan kualitas air yang baik. Hal ini menunjukkan bahwa kandungan air pada *midleward* di Pulau Sembilan memiliki kondisi air yang terglong buruk.

Tabel 4. 6 Hasil Klasifikasi *Landward Zone*

	Ketinggian Air	Suhu Air	Suhu Udara	Kelembapan Udara	ORP	pH	Salinitas(TDS)	DO
Titik 1	29 cm	29.56	27.00	38.00%	132.71 Mv	11.67	517.54 ppm	29.01 ppm
Titik 2	32 cm	29.00	28.00	39.00%	151.60 Mv	10.41	520.27 ppm	28.96 ppm
Titik 3	27 cm	28.94	28.00	39.00%	154.94 Mv	11.76	520.95 ppm	28.05 ppm
Titik 4	35 cm	29.31	28.00	36.00%	113.95 Mv	9.48	511.39 ppm	27.82 ppm

Pada zona *landward*, bahwa kondisi kualitas air juga terlihat buruk.

Hasil LSTM

Hasil yang didapatkan dari identifikasi tingkat kelayakan hidup jenis mangrove Desa Pulau Sembilan berdasarkan kandungan air dengan menggunakan *Long Short Term Memory* (LSTM) akan dipaparkan pada bagian ini. Proses pengujian ini menggunakan 2342 record data. Setelah *dataset* ditentukan, maka kita akan masuk ke tahapan preparation, kalau *dataset* sudah baik kemudian dilanjutkan dengan membaginya menjadi 70% *training* dan 30% *testing.*

Tabel 4. 7 Jumlah Dataset.

No	Data	Jumlah
1	*Training*	1639 baris
2	*Testing*	703 baris

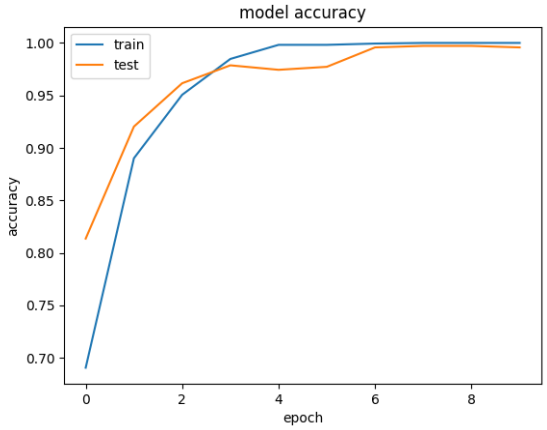
Sebelum melakukan training dan testing, ditentukan terlebih dahulu paramater yang ditunjukkan ada Gambar 4.1.

Optimizer	*Activation*	*Epoch*	*Learning Rate*	*Batch Size*	*Neuron*	*Loss*
Adam	Softmax	10	0,001	52	100	Categorical Crossentropy

Gambar 4. 1 Tabel Parameter yang digunakan untuk pengujian

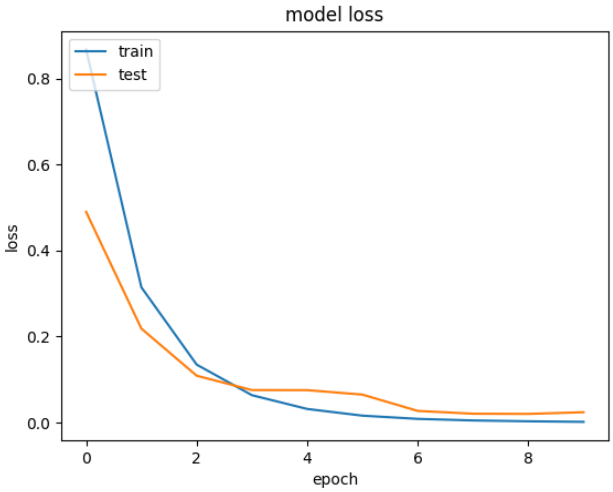
Hasil Nilai Loss *LSTM*

Berdasarkan hasil pengujian yang sudah dilakukan algoritma Long Short Term Memory (LSTM), didapatkan hasil nilai accuracy training dan loss training seperti gambar berikut :



Gambar 4. 2 Grafik *accuracy training* pada algoritma LSTM

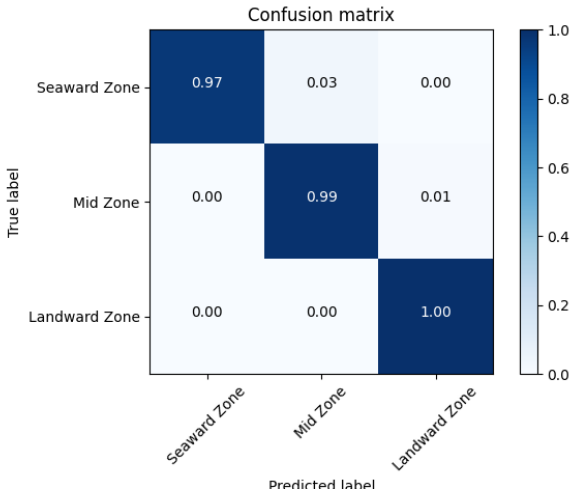
Pada Gambar 4.2 menunjukkan bahwa model sudah cukup baik dengan akurasi sebesar 0.994 atau 99%, bahwa akurasi dari model data *training* dengan data *testing* memiliki kemiripan yang dekat sehingga dalam pengujian ini *overfitting* tidak terjadi pada aplikasi.



Gambar 4. 3 Grafik *loss training* dan *loss testing* pada algoritma LSTM

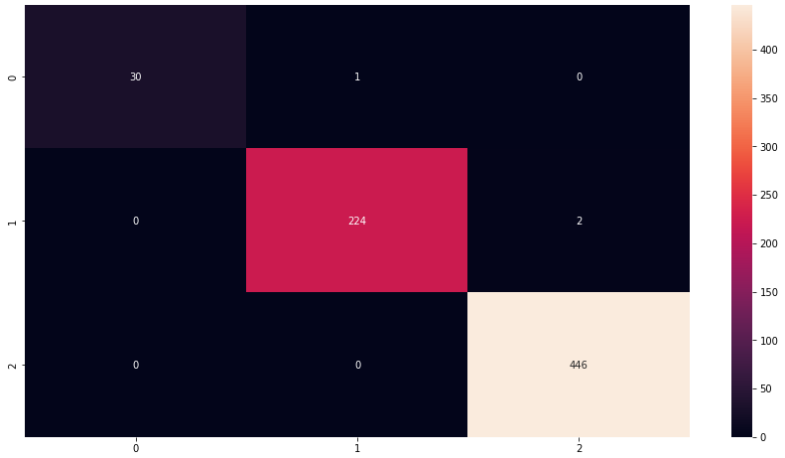
Pada gambar 4.3 bisa disaksikan bahwa *loss* dari data *training* dan data *testing* saling mendekati dengan *loss* sebesar 0.014. Nilai *loss training* dan *loss validation* pada algoritma LSTM

menjadi landai dan grafik berhimpit di antara epoch ke-2 hingga epoch ke-10, sehingga tidak terjadi overfitting. Hal ini menandakan bahwa model yang dibuat cukup akurat.



Gambar 4. 4 *Visualisasi confusion matrix* zona mangrove

Sebelum pengujian data *testing*, dilakukan identifikasi jumlah data dari setiap zona mangrove. *Result* menunjukkan data *landward zone* lebih mendominasi dengan total 1485 data dibandingkan *mid zone* 752 data dan *seaward* berjumlah 105 data, selengkapnya dari hasil perbandingan ini dapat diketahui pada gambar confusion matrix di bawah :



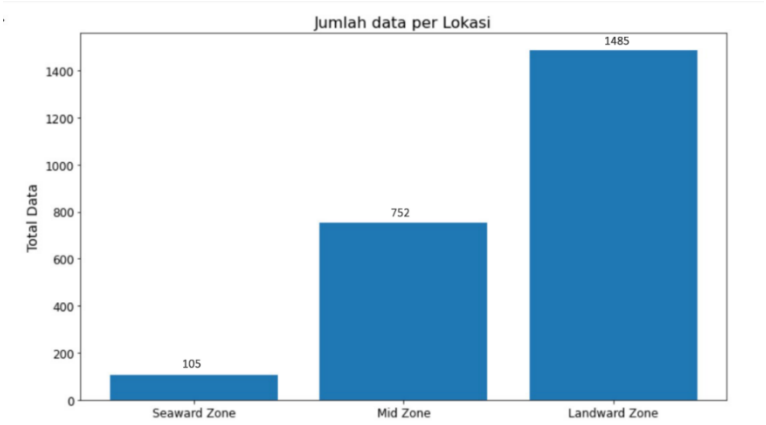
Gambar 4. 5 C*onfusion matrix* hasil prediksi

Gambar diatas merupakan gambaran dari hasil prediksi menggunakan model yang telah di *training* sebelumnya. *Confusion matrix* didapat melalui pengujian antara data label yang sebenarnya dan data label hasil prediksi. Dari hasil tersebut dapat kita lihat bahwa *true positive* dari hasil prediksi menunjukkan hasil yang baik untuk setiap label yang mana untuk *seaward zone* 97% label berhasil diprediksi, selanjutnya *mid zone* dengan 99%, dan *landward zone* adalah 100%. Dari hasil tersebut dapat disimpulkan bahwa model *training* menunjukkan hasil yang bagus untuk melakukan prediksi. Untuk selanjutnya ditampilkan nilai *f1 score, precision,* dan *recall* pada Gambar 3.6 untuk melakukan evaluasi terhadap model yang ditraining.

	precision	recall	f1-score	support
1	1.00	0.97	0.98	31
2	1.00	0.99	0.99	226
3	1.00	1.00	1.00	446
accuracy			1.00	703
macro avg	1.00	0.99	0.99	703
weighted avg	1.00	1.00	1.00	703

Gambar 4. 6 evaluasi *model f1 score, recall, dan precision*

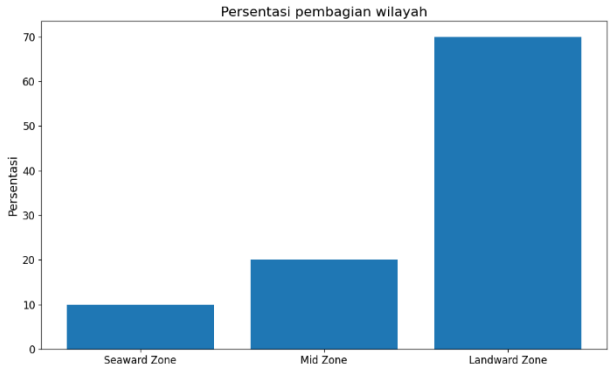
Pada Gambar 4.6 dapat dilihat bahwa nilai *f1 score*, *recall*, *dan precision* menunjukkan hasil yang sangat baik. Sebelum pengujian data *testing*, dilakukan identifikasi jumlah data dari setiap zona mangrove. *Result* menunjukkan data *landward zone* lebih mendominasi dengan total 1485 data dibandingkan *mid zone* 752 data dan *seaward* berjumlah 105 data seperti yang terlihat pada Gambar 4.7.



Gambar 4. 7 Total data pada setiap zona

Hasil uji data testing

Pada tahapan ini, peneliti melakukan pengujian terhadap model data testing yang dibuat. Hasil yang diperoleh melalui tahap pengujian ini tertera pada gambar berikut ini:



Gambar 4. 8 Persentase pembagian zona

Berdasarkan gambar 4.8 dapat dilihat bahwa terdapat 3 Zona dalam peneltian ini yaitu Seaward Zone, Mid Zone dan Landwad Zone. Persentase pembagian zona ini juga dapat diketahui melalui tabel berikut:.

Tabel 4. 8 Persentase zona mangrove

No	Data	Jumlah
1	*Seaward Zone*	10%
2	*Midward Zone*	20%
3	*Landward Zone*	70%

Tabel diatas menjelaskan hasil dari identifikasi mangrove berdasarkan kandungan air di pulau sembilan yang dibagi dalam 3 zona. Terlihat bahwa *Landward Zone* mendominiasi dengan hasil 70%, *Mid Zone* 20% dan *Seaward Zone* 10%.

BAB 5. KESIMPULAN

Berdasarkan hasil pengumpulan data dan monitoring zona tanam mangrove secara *near realtime* dengan menggunakan metode *wireless sensor network.* Dalam proses pengumpulan data telah didapat beberapa kesimpulan, yaitu :

1. Jenis mangrove *Avicennia/Sonneratia* dapat tumbuh pada zona dekat dengan bibir pantai (*seaward zone*) yang ada dipulau Sembilan.
2. Jenis mangrove *Rhizophora apiculate* dapat tumbuh pada zona yang memiliki lapisan snedimen berlumpur (*middle zone*) yang ada di pulau Sembilan.
3. Jenis mangrove *Ficus microcarpus didapati dapat tumbuh pada zona yang jauh dari bibir pantai (Landward zone) yang ada di pulau Sembilan.*
4. Hasil akhir yang didapat dalam pengumpulan data kandungan air zona mangrove berjumlah 3.200 data.
5. Kondisi kandungan air zona mangrove pada lokasi penelitian terbilang buruk namun masih layak untuk perkembangan tanaman mangrove.
6. Berdasarkan pemaparan implementasi dan pembahasan, dapat disimpulkan bahwa identifikasi tingkat kelayakan jenis tanaman mangrove menggunakan data yang ada bisa dilakukan dengan baik menggunakan algoritma *Long Short Term Memory.*
7. Dari hasil pengujian menggunakan algortima *Long Short Term Memory* didapatkan hasil akurasi yang mencapai angka 0.994 atau 99%, melalui implementasi dan kombinasi fungsi aktivasi *softmax* dengan *optimizer* Adamax.
8. *Long Short Term Memory* mampu melakukan proses training dan testing 60 epoch dalam durasi waktu 1 menit.

DAFTAR PUSTAKA

1. Ambrosetti, W., & Barbanti, L. 2001., Temerature, heat, content, mixing, and stability in Lake Orta: A pluriannual investigation. Journal of Limnology. 60(1):60-68.
2. Adamo, F., Attivissimo, F., Carducci, C. G. C., & Landzolla, A. M. K. 2014. A smart sensor network for sea water quality monitoring. IEEE Sensor Journal, 15(5): 2514-2522.
3. Bengen, D. G. 2002. Sinopsis ekonomi dan sumberdaya alam pesisir dan laut serta Prinsip pengelolaannya. Pusat Kajian Sumberdaya Pesisir dan Lautan IPB: Bogor, 63
4. Ditjen, R. L P. S. 2001. Kriteria dan standar teknis rehabilitasi wilayah pantai. Direktorat Jenderal Rehabilitasi Lahan dan Perhutanan Sosial, Departemen Kehutanan RI
5. Deepiga, T., & Sivakansari, A. 2015. Smart water monitoring system using wireless- sensor network at home/office. International Research Journal of Engginering and Technology. 2(4): 1305-1314
6. Rahmat, R. F., Athmanathan, Syahputra, M. F., & Lydia, M. S. 2016. Real Time Monitoring System for Water Pollution in Lake Toba. International Conference on Informatics and Computing (ICIC). Medan: IEEE.
7. Gupta, C. P., & Kumar, A. 2013. Wireless sensor networks: A review. International Journal of Sensors Wireless Communications and Controls. 3(1): 25-36.
8. Harianja, R., Pangaribuan, N., Sinaga, L., Siagian, P., & Sembiring, E. R. 2017. Smart monitoring APPS for salvaging neolissochillus thienemanni- sumateranus (batak heritage) from extinction. In 2017 International Conference on Electrical Engineering and Computer Science (ICECOS) (pp. 56-6-). IEEE
9. Kathiresan, K. 2012. Importance of mangrove ecosystem. International Journal of Marine Science. 2(10).
10. Khaleeq, H., Abou-ElNour, A., & Tarique, M. 2016. A reliable wireless system for water quality monitoring and level control. Netw. Protoc. Algorithms, 8(3): 1-14.
11. Majid, L., Al Muhdar, M. H. L., Rohman, F., & Syamsuri, I. 2016. Konservasi huta mangrove di pesisir pantai Kota Ternate terintegrasi dengan kurikulum sekolah. BIOEDUKASI. 4(2).
12. Nasirudin, M. A., Za'bah, U. N., & Sidek, O. 2011. Fresh water real-time monitoring System based on wireless sensor network and GSM. In 2011 IEEE Conference on Open Systems (pp.354-357). IEEE.
13. Onrizal., O., & Masor, M. 2016. Status of coastal forest of the Northem Sumatra in 2004 tsunami catastrophe. Biodiversitas Journal of Biological Diversity. 17(1).
14. Pattipeilohy, M. 2014. Fenomena pendangkalan zona pasang surut hutan mangrove teluk dalam ambon serta upaya pengembangan ekowisata. Journal Pena Sains. 1(2): 56-63.
15. Pozzebon, A., Cappelli, L., Mecocci, A., Bertoni, D., Sarti, G., & Alquini, F. 2018. A wireless sensor network for real-time remote measurement of Aeolian sand Transport in Sandy Beaches and Dunes. Sensors, 18(3): 820.
16. Romanach, S. S., DeAngelis, D. L., Koh, H. L., Li, Y., The, S. Y., Barizan, R. S. R., & Zhai, L. 2018. Conservation and restoration of mangroves: Global status, perspectives, and prognosis. Ocean & Coastal Management. 154: 72-82.

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Real Time Wireless Sensor with Distributed Adaptive Neuro-Gen Learning Engine for Mangrove Planting Zone Classification

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A B S T R A C T

Waste disposal by the community to the beach in Pulau Sembilan Village, Pangkalan Susu District, Langkat Regency, creates water pollution and reduces the population of mangrove plants. To improve the population of mangrove plants, an accurate water content identification system is needed so that mangrove planting in Pulau Sembilan can be targeted according to the existing zones. In this study, the Long Short Term Memory algorithm was identified using mangrove water content data in Pulau Sembilan Village, Langkat Regency as training and testing data. The loss from the training and testing data approached each other with a loss of 0.014. The result obtained in this study is a system accuracy of 99% by applying a combination of Adamax optimizer and softmax activation function.

1. Introduction

Indonesia is home to the largest mangrove forest in the world, covering over 3 million hectares or 22.6% of the world's total mangrove area (Giri et al. 2011). In Asia, Indonesia's mangrove forest area accounts for nearly half of the total mangrove forest, followed by Malaysia and Myanmar (FAO, 2007). Despite this, Indonesia also has the dubious distinction of contributing the largest amount of damage to mangrove forests compared to other countries. According to the Indonesian Ministry of Forestry, mangrove forest damage in Indonesia has reached a staggering 57.6% (RLPS, 2001).

Mangroves are important ecosystems found along protected coastlines in tropical and sub-tropical areas, where they serve various socio-economic functions (FAO, 2007). These coastal areas are transitional ecosystems influenced by land and sea, and they include several ecosystems, one of which is the mangrove forest ecosystem (Bengen, 2002). Mangrove forests are tree ecosystems that can survive in environments with high salt concentrations. The mangrove ecosystem also serves as a buffer for aquatic fauna systems as it provides a habitat for several aquatic organisms.

Unfortunately, the number of mangroves has significantly decreased in recent years due to excessive utilization and pollution of the mangrove ecosystem. The mangrove forest ecosystem in Indonesia is currently in critical condition, with around 68% or 5.9 million hectares of the total area of 8.6 million hectares damaged (Ilham et al. 2016). While efforts have been made to plant mangroves and raise awareness, the cultivation of mangroves is still not optimal due to the lack of a proper method for classifying and monitoring their development. This is because each mangrove has different characteristics for growing in different zones.

Various research has been conducted to monitor and classify mangroves, but data collection still needs to be done manually in the field, such as collecting data on pH, water salinity, air humidity, and water oxidation ability. This results in high operational costs and low efficiency in data collection. To minimize time and costs, measurements should be made by implementing sensors and information technology. This is where the use of innovative techniques such as remote sensing, Geographic Information Systems (GIS), and unmanned aerial vehicles (UAVs) can play a crucial role in the management and monitoring of mangrove forests (Lambrou et al. 2014).

For the management and preservation of mangrove forests, identification of mangrove species using machine learning is needed. This identification will

apply the Long Short Term Memory Algorithm to determine the types of mangroves that are suitable for the established ecosystem zones.

Moreover, the use of Long Short Term Memory algorithm to identify water content has been conducted by (Ridho, 2014) in his research to identify the feasibility level of endemic fish in a location in Lake Toba waters measured by its water content using Long Short Term Memory. The results of the testing of the Haranggaol dataset using the best combination of optimizer and activation function showed that the feasibility level of fish was 99.84% with an optimal water content of 0.07%, a tolerable water content of 99.84%, and a poor water content of 0.07%.

Based on the previous explanation, the author chooses a research topic that can help prevent the decrease of mangrove population caused by improper preservation and management of mangrove forests, with the research title "Identification of Feasibility Level of Mangrove Species in Pulau Sembilan Village Based on Water Content Using Long Short Term Memory".

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2. Literature Review

This chapter discusses the literature on the use of wireless real-time sensors for mangrove planting zone classification using distributed adaptive neuro-gen learning engine.

2.1. Mangrove Zone Classification

According to Irwanto (2014), the zonation classification of mangrove growth is based on the sedimentation area and the types of plants that grow in that area. The classification of mangrove zones is as follows:

1) Seaward Zone
   It is the zone that is closest to the sea or the front zone on the coastline. In this zone, the types of mangrove plants that can be found are usually Rhizophora apiculata, Rhizophora mucronata, and Sonneratia alba.

2) Midward Zone
   The middle zone is the zone located between the sea and the land, or commonly referred to as the zone that is in the middle between the land and the coastline. In this area, the types of mangrove plants that can be found are usually Sonneratia caseolaris, Rhizophora alba, Bruguiera gymnorhiza, Avicennia marina, Avicennia officinalis, and Ceriops tagal.

3) Landward Zone
   It is the zone that is furthest from the coastline and is generally the least affected by seawater. In this zone, the dominant types of mangrove plants are usually Heritiera littoralis, Pongamia sp, Xylocarpus sp, Pandanus sp, and Hibiscus tiliaceus.

2.2. Near Real-Time

In IoT, data transmission to the server cannot always be done directly/real-time. Near real-time is where the speed of processing data is important but the processing can still be done within minutes. According to Cristy Wilson (2021), an example of a near real-time process is an intelligent operational system, which is a combination of data processing and complete event processing (CEP). CEP involves using data from various sources to detect patterns, which is useful for identifying opportunities in data sets such as sales prospects as well as intrusion threats on the internet network,

2.3. Water Content

Water is a chemical substance with the chemical formula H2O. One molecule of water consists of two hydrogen atoms covalently bonded to one oxygen atom (Ball, 2005). Water has hydrogen bonds that tend to stick together to resist external forces that may break these bonds. Water is also the most essential substance needed by living organisms (Umanitoba, 1997). There are various types of water such as river water, seawater, rainwater, lake water, and others. Generally, the content of water is hydrogen and oxygen, but in certain conditions, the content can increase depending on the type of water.

2.4. *pH*

Seawater generally has a pH value above 7 which means it is basic, but under certain conditions, its value can become lower than 7 and become acidic. Most aquatic organisms are sensitive to changes in pH value, with the ideal value for life between 7 - 8.5. At a lower pH value (<4), most aquatic plants die because they cannot tolerate low pH (Susana, 2009).

Changes in water quality can cause seawater that is basic (pH > 7) to become acidic (pH < 7). The low pH value indicates a decrease in water quality, which ultimately affects the life of organisms in it. The occurrence of this change will kill even the most sensitive organisms because the food chain in the water is disrupted. One of the chemicals widely used for industrial and household purposes, detergent, turns out to reduce the pH value and oxygen concentration in river flows which eventually flow into the surrounding waters (Susana, 2009).

The pH value in water varies from the direction of the river to the sea, the closer to the sea, the higher the value (basic). Low pH values are generally obtained in river bodies, and as it approaches the sea, the value increases. The safe pH values for aquatic life are between 6.5 - 8 (Welch, 1980).

2.5. *Water Temperature*

Temperature stratification in a body of water plays an important role in the ecological processes of water bodies. (Walter et al, 2001) state that the vertical temperature profile in a lake is necessary to determine heat content in the water, the thermocline layer, and the mass mixing of water in the water body.

2.6. *Dissolved Oxygen*

The concentration of dissolved oxygen within certain limits also indicates a change in water quality, the lower the concentration, the lower the water quality (Anonim, 1998).

The concentration of oxygen will reduce the physiological activity of living organisms in the water. In their research, (Welch, 1980) found a decrease in appetite, growth, and swimming speed of fish when the oxygen concentration is less than 8 ppm. Dissolved oxygen in seawater comes from air diffusion, photosynthesis of phytoplankton and benthic plants. Its presence in seawater is crucial for the survival of microorganisms that live in aerobically in water (Susana, 2009).

2.7. *Sensors*

Sensors are devices that are used to measure and detect physical or chemical quantities and convert them into signals that can be read and interpreted. They are widely used in various fields such as industry, agriculture, health, and environmental monitoring.

One type of sensor commonly used is the pH sensor. The pH sensor is used to measure the acidity or alkalinity of a solution. pH sensors work based on the principle of ion-selective electrodes. The pH sensor generates an electric voltage that is

proportional to the pH of the solution. The output from the pH sensor is usually analog and requires calibration to obtain accurate readings.

The dissolved oxygen sensor kit is another type of sensor that is widely used in environmental monitoring. The dissolved oxygen sensor kit is used to measure the amount of oxygen dissolved in water. The dissolved oxygen sensor kit consists of a circuit and a probe sensor. The circuit generates a small electric voltage that is proportional to the amount of dissolved oxygen in the water. The dissolved oxygen sensor kit can operate at a voltage range of 3.3V to 5V and has a high level of accuracy.

The DHT11 air temperature and humidity sensor is used to measure temperature and humidity. The DHT11 sensor is a single-wire digital sensor that operates on a power supply of 3.3V to 5V. The DHT11 sensor generates a digital output that can be read and interpreted by a microcontroller.

The ORP meter is used to measure the oxidation-reduction potential (ORP) of a solution. The ORP meter generates an electric voltage that is proportional to the ORP of the solution. The ORP meter is an analog sensor that operates on a power supply of 3.3V to 5V and communicates using a BNC connector.

The salinity sensor is used to measure the salt content of a solution. The salinity sensor consists of two electrodes that are dipped in a solution and an electric current is passed through the solution. The conductivity of the solution is measured and converted into a signal that can be read and interpreted.

The ultrasonic sensor is used to measure distance. The ultrasonic sensor works based on the principle of sound waves. The sensor emits ultrasonic waves and measures the time it takes for the waves to bounce back to the sensor. The XL-MaxSonar-EZ3 is an ultrasonic sensor used to measure distance and operates on a power supply of 3.3V to 5.5V.

The GSM + GPRS Shield is used to send GPRS signals to the internet. The GSM Shield is commonly used by connecting it to a microcontroller. The microcontroller receives data from various connected devices and sends the data to the internet.

2.8. LSTM

Long Short-Term Memory (LSTM) is a type of recurrent neural network (RNN) architecture that is designed to overcome the problems of vanishing gradients and short-term memory in traditional RNNs. LSTMs are widely used in natural language processing (NLP), time series, speech recognition, image captioning, and many other applications where sequential data is involved.

The activation functions used in LSTMs are usually the sigmoid function and the hyperbolic tangent (tanh) function. The sigmoid function is used to compute the gates, which have a range between 0 and 1, and the tanh function is used to compute the candidate values for the memory cell, which have a range between -1 and 1.

LSTMs have been shown to be very effective in capturing long-term dependencies in sequential data, and they have achieved state-of-the-art performance in many time series and NLP tasks.

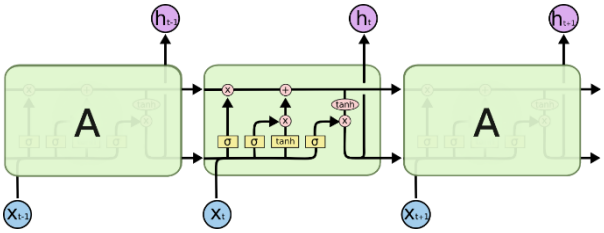

Fig. 1. LSTM Structure (colah.github.io)

3. Methodology

The methodology chapter serves as a critical component of any research study, as it provides a detailed explanation of the methods and procedures utilized to answer the research questions. This chapter outlines the step-by-step process of how data was collected, analyzed, and interpreted to achieve the research objectives. In this chapter, we will discuss the research design, sample selection, data collection methods, data analysis techniques, and the ethical considerations considered throughout the research process. By providing a transparent and thorough explanation of the research methodology, this chapter aims to establish the credibility and reliability of the research findings.

3.1. Data Collection

The data are obtained from a sensor device in the form of pH, water salinity, dissolved oxygen in the water, water temperature, air temperature, tidal water level, and the ability of the solution oxidation in the water. Then, the data will be processed through three stages, namely converting analog string data into digital data using the Analog Digital Converter (ADC). Then, the digital data is sent to the hosting database using the GSM+GPRS Shield (SIM L800), so that it can be displayed and monitored using a computer. The data collection process can be seen in Fig. 2.

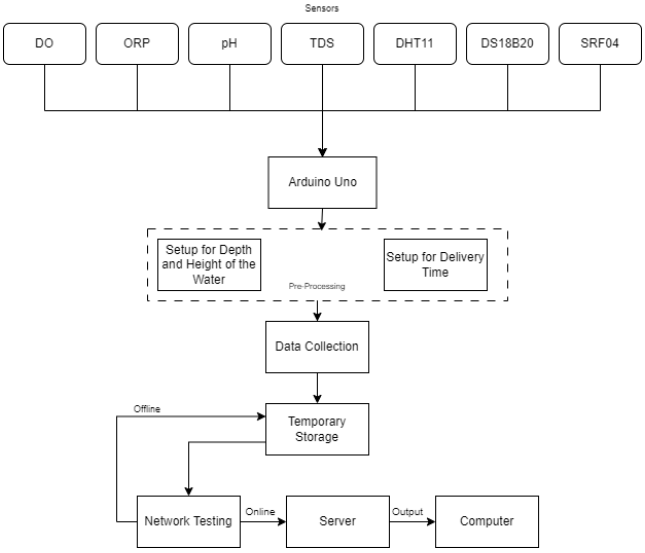

Fig. 2. Data Collection Architecture

3.2. *Hardware and Software Implementation*

This research conducted the data sensing stage first, followed by the data transmission stage to the server and displaying the data results stored in the database. To visualize the testing results, it will be implemented into the system using HTML programming language integrated with PHP programming language. Meanwhile, for the database management, it will be used with the MySQL programming language.

For the hardware, it was setup in Pulau Sembilan Village, Pangkalan Susu District, Langkat Regency. The implementation location is divided into 3 zones. These zones are the seaward zone, midward zone, and landward zone as stated in Chapter 2.

Fig. 3. Design Implementation Location

As for the implementation of the device in the field, it is done by finding a flat area or installing a stake placed between the mangrove roots. The placement of the hardware can be seen in Figure 4.

Fig. 4. Hardware Implementation for Water Content Data

3.3. *General Architecture*

The process of the proposed Wireless Real Time Wireless Sensor with Distributed Adaptive Neuro-Gen Learning Engine for Mangrove Planting Zone Classification involves several steps starting from data input allocation, data preparation, data training normalization, and data testing.

Firstly, the data input allocation includes separating the dataset into training and testing datasets. The training dataset is used to build the LSTM model, while the testing dataset is used to evaluate the performance of the model.

Secondly, data preparation involves cleaning the dataset by removing any outliers or missing data. Additionally, each data point is labeled based on the mangrove planting zone it belongs to.

Thirdly, data training normalization is conducted using the training dataset to build the LSTM model. This includes building the model architecture, inputting the training data into the model, and validating the performance of the model using a validation dataset. The result of the training process is a trained LSTM model that can be used for classification.

Finally, the trained LSTM model is used to classify the testing dataset. The classification result is then evaluated based on metrics such as accuracy, precision, and recall. The general architecture can be seen in Fig 5.

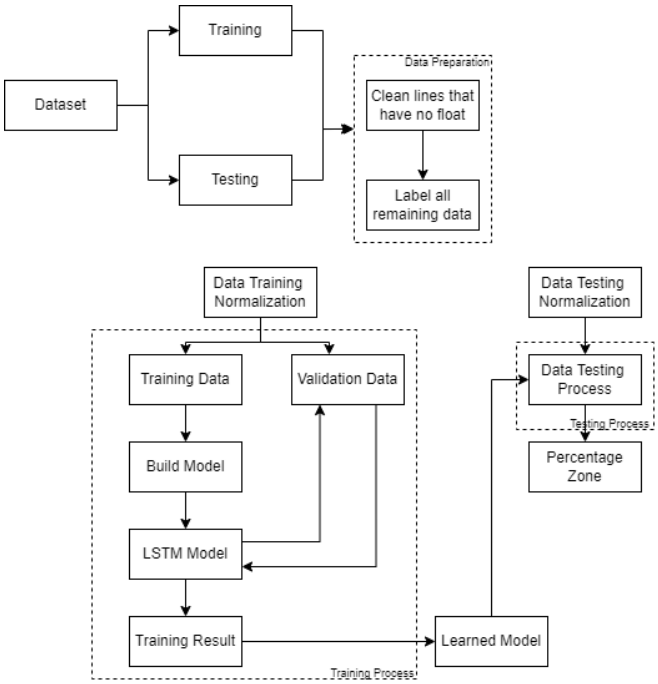

Fig. 5. General Architecture

3.1.1. Input Data

The data source used in conducting this research test is in CSV (Comma Separated Value) file format. The data consists of 10 attributes including water level, water temperature, air temperature, air humidity, TDS, ORP, DO, pH, datetime, and location from the mangrove zone in Pulau Sembilan Village with a total of over 2000 raw data.

3.1.2. Data Preparation

Data preparation or commonly referred to as data preprocessing is the normalization process carried out on the dataset to match the predetermined values. In this study, the data preparation stage is divided into two stages, namely data cleaning and data labeling.

3.1.2.1. Data Cleaning

In data cleaning, the process of selecting data is carried out to check for repeated data and remove or fix instances or features that are incorrect in the dataset. Incorrect data will be discarded as it can reduce the level of accuracy. This cleaning process can be illustrated in Fig 6.

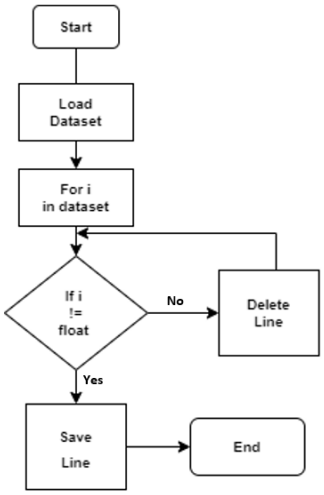

Fig. 6. Data Cleaning Process

Based on Figure 6, first the dataset will be loaded, then each row will be checked repeatedly to see if it is a decimal number (float) or not, as many times as there are rows in the dataset. If there is a blank data on a certain row, the row will be filled with the number 0. This process continues until the last row of data. Next, data parameters that will not be used in the study will be deleted such as water level, air temperature, air humidity, TDS, and ORP. Thus, only the pH, water temperature, and DO parameters remain.

3.1.2.2. Data Labelling

The final process of data preparation is data labeling, where data labeling is carried out to determine the output based on the features used, namely air temperature, pH, and Dissolved Oxygen (DO).

After the data preparation process is complete, the file will be saved into a new CSV file consisting of 4 columns, namely pH, water temperature, DO, and label. The output of the process can be seen in the following table:

Table I. Data Preparation Result

pH	Water Temperature	DO	Label
8.83	29.94	29.32	3
8.65	29.34	29.13	3
8.21	29.12	28.98	3
7.94	29.27	28.48	3

3.1.3.Data Processing

In the process stage, two parts are carried out, namely the testing process and the training process. The data is divided into 2, 70% of the data for testing and 30% of the data for validation. Next, a model is created based on the input parameters.

The number of nodes in the neural network is first determined, especially in the hidden layer, because the hidden layer has an important role in calculating the final result of the neural network. In this study, the modeling used LSTM which has 3 hidden layers.

3.1.3.1. Training Process

In the process stage, two parts are carried out, namely testing and training. The data is divided into 70% for testing and 30% for validation. Then, the model is created based on the input parameters.

The number of nodes in the neural network is determined first, especially in the hidden layer, as the hidden layer plays an important role in calculating the final result of the neural network. In this study, LSTM modeling is used, which has three hidden layers.

In the training process, LSTM modeling is carried out by determining the number of hidden layers, the level of neurons, and the number of epochs to be used. Then, the training process will be run, where the model will be trained using the provided training data. The training data will be processed using the lstm model. In the lstm model, the data will enter the neuron through the hidden layer.

In one neuron, the data located in the cell state will go through the forget gate to determine whether the data will be kept or discarded, where the determination is made through the activation function and two conditions. If the result is 0, the data in the cell state will be discarded, and if the result is 1, the data will be kept. Next, the data in the cell state will be continued through the input gate, where this input gate has two functions, namely to update or add data to the cell state.

After the data is modified and added, the updated data in the cell state will be continued through the output gate. Where the data in the cell state will be changed to be delivered to the next neuron through the next hidden layer, and this process will continue for as many epochs, which is 10. In this study, the data stored in the cell state are pH, temperature, DO, and label, where this data will affect the identification of mangroves.

Weights and biases will continue to be updated to obtain a suitable model. After one iteration of the training process is completed, the validation process is carried out to determine the performance of the trained model. The training result will be validated in each batch with the validation dataset to see if the results given match the actual values. The validation process will produce an error called loss. The output of this process is a neural network model called the learned model, which has finished training and will be loaded again when performing the testing process. In addition, the total accuracy and loss will also be printed at the end of each training process.

3.1.3.2. Testing Process

After obtaining the model from the training process, the next step is to perform testing using the testing data obtained from the preparation process.

The learned model is loaded back and calculates the output based on the parameters given during the training process that are already included in the learned model. This step is carried out to determine the effectiveness of the Long Short Term Memory (LSTM) algorithm in the identification process.

3.1.3.3. Output

The output of the whole process using LSTM is the percentage of the survival rate of the mangrove plants in Pulau Sembilan divided into 3 zones, and presented in the form of diagrams and tables.

4. Result and Discussion

The results obtained from the identification of the viability level of the Pulau Sembilan mangrove plant species based on water content using Long Short Term Memory (LSTM) will be presented in this section. This testing process uses 2342 data records. After the dataset is determined, we will enter the preparation stage, if the dataset is good, then proceed to divide it into 70% for training and 30% for testing.

Table II. Dataset

No	Data	Amount
1	Training	1639 lines
2	Testing	703 lines

Before performing training and testing, the parameters shown in Fig 7 are determined first.

Optimizer	*Activation*	*Epoch*	*Learning Rate*	*Batch Size*	*Neuron*	*Loss*
Adam	Softmax	10	0,001	52	100	Categorical Crossentropy

Fig. 7. Testing Parameter

4.1. LSTM Loss Value Result

Based on the results of the Long Short Term Memory (LSTM) algorithm testing, the training accuracy and training loss values were obtained as shown in the following figure.

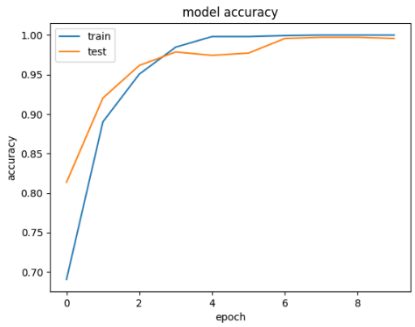

Fig. 8. Accuracy Graph of LSTM Training Result

It can be seen from Fig 8 that the model is good enough with an accuracy of 0.994 or 99%, indicating that the accuracy of the model on training data and testing data is very close, indicating that overfitting did not occur in this application.

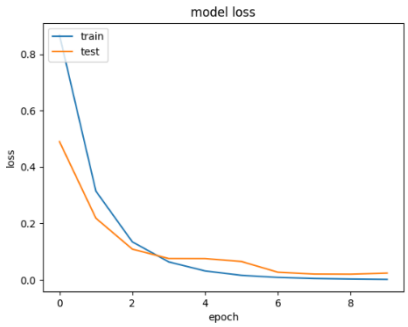

Fig. 9. Loss Values of LSTM Training and Testing Result

In Fig 9, it can be seen that the loss for training and testing data approaches each other with a loss of 0.014. The training and validation loss values of the LSTM algorithm are gradually decreasing, and the graphs are close together from epoch 2 to epoch 10, indicating that there is no overfitting. This indicates that the model created is accurate enough.

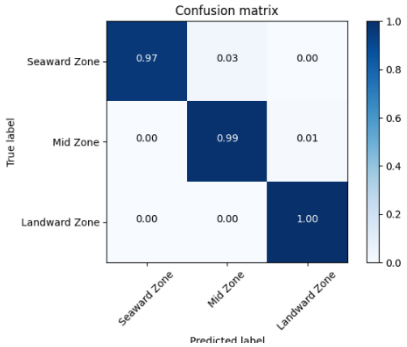

Fig. 10. Confusion Matrix Visualization for Mangrove Zones

Before testing the data, the identification of the amount of data for each mangrove zone was carried out. The results showed that the landward zone data was dominant with a total of 1485 data compared to 752 for the mid zone and 105 for the seaward zone. The details of the comparison results can be seen in the confusion matrix in the figure below.

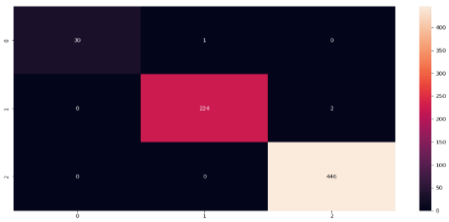

Fig. 11. Confusion Matrix of Prediction Result

The figure above is a representation of the prediction results using the previously trained model. The confusion matrix was obtained by testing between the actual label data and the predicted label data. From these results, it can be seen that the true positive of the prediction results shows good results for each label, with 97% for the seaward zone, 99%

for the mid zone, and 100% for the landward zone. It can be concluded that the training model shows good results for predictions. The f1 score, precision, and recall values are displayed in Figure 12 for further evaluation of the trained model.

	precision	recall	f1-score	support
1	1.00	0.97	0.98	31
2	1.00	0.99	0.99	226
3	1.00	1.00	1.00	446
accuracy			1.00	703
macro avg	1.00	0.99	0.99	703
weighted avg	1.00	1.00	1.00	703

Fig. 12. Model Evaluation Score

In Fig 10, the f1 score, recall, and precision values show excellent results. Before testing the data, the identification of the amount of data for each mangrove zone was carried out. The results showed that the landward zone data was dominant with a total of 1485 data compared to 752 for the mid zone and 105 for the seaward zone, as shown in Fig 13.

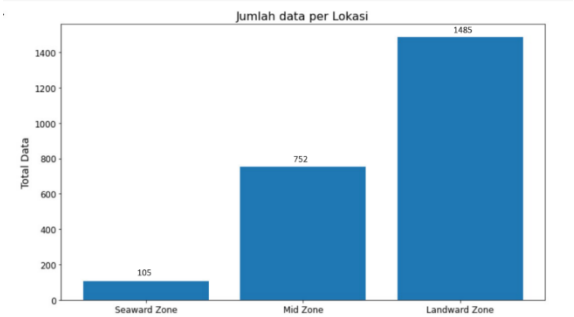

Fig. 13. Data Amount of Each Zone

4.2. *Testing Data Result*

During this phase, the researchers conducted testing on the testing data of the created model. The results obtained from this testing phase are shown in the following figure:

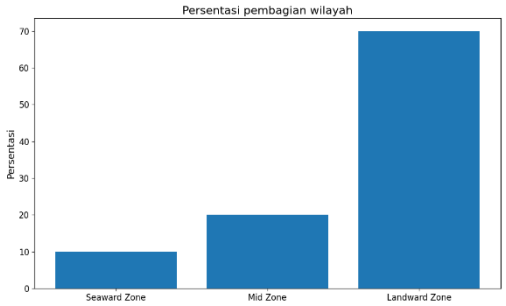

Fig. 14. Zone Classification Percentage

Based on Figure 14, there are three zones in this study, namely the Seaward Zone, Mid Zone, and Landward Zone. The percentage distribution of these zones can also be seen in the following table:

Table III. Mangrove Zone Percentage

No	Zone	Percentage (%)
1	Seaward	10
2	Midward	20
3	Landward	70

The table above explains the results of the identification of mangroves based on water content in Pulau Sembilan, which is divided into three zones. The Landward Zone dominates with a result of 70%, followed by the Mid Zone with 20% and the Seaward Zone with 10%.

5. Conclusion

Based on the testing results of the Long Short Term Memory algorithm used for identifying mangrove plant species in Pulau Sembilan Village, several conclusions can be drawn:

1. Based on the implementation and discussion, it can be concluded that the identification of mangrove plant species' feasibility can be done well using the Long Short Term Memory algorithm.
2. From the testing results using the Long Short Term Memory algorithm, an accuracy of 0.994 or 99% was obtained, through the implementation and combination of the softmax activation function with the Adamax optimizer.
3. Long Short Term Memory was able to perform 60 epochs of training and testing in a duration of 1 minute.

References

Adnan S Wantasen, (2013). Kondisi kualitas perairan dan substrat dasar sebagai factor pendukung aktivitas pertumbuhan mangrove di pantai pesisir Desa Basaan I, Kabupaten Minahasa Tenggara.

Ahmad, Rudi, Rusdi. (2016). Status Ekologi Mangrove Pulau Sembilan, Kabupaten Langkat Provinsi Sumatera Utara.

Andi Aprilianto, Retno Kusumaningrum, (2020). Hoax Detection In Indonesian Languange Using Long Short-Term Memory Model.

Ball, P. (2005). Water and life: Seeking the solution.

Eka Sapta, Budi Utomo, Yunasfi. (2016). Identifikasi jenis-jenis mangrove yang bermanfaat secara ekonomi bagi masyarakat di Pulau Sembilan dan Pulau Kampai, Kabupaten Langkat.

Habib Faizal Fadli, Ahmad Fathan Hidayatullah, (2021). Identifikasi Cyberbullying pada Media Sosial Twitter Menggunakan Metode LSTM dan BiLSTM.

Huang, M., Zhang, T., Wang, J. and Zhu, L., (2015) September. A new air quality forecasting model using data mining and artificial neural network. In Software Engineering and Service Science (ICSESS), 2015 6th IEEE International Conference on (pp. 259-262). IEEE

Ibrahim, (2021). Klasifikasi dan monitoring zona mangrove secara real time dengan menggunakan Wireless Sensor Network.

Index, A.Q., (2015). A guide to air quality and your health. USA: EPA.

Jasman Pardede, Raka Gemi Ibrahim, (2020). Implementasi Long Short -Term Memory Untuk Identifikasi Berita Hoax Berbahasa Inggris Pada Media Sosial.

Koedsin W, Vaiphasa C. 2013. Discrimination of Tropical Mangroves at the Species Level with EO-1 Hyperion Data. Remote Sensing. 5: 3562-3582. doi:10.3390/rs5073562.

Muhammad Furqan, Romi Fadhillah Rahmat, Sarah Purnamawati (2018). Identifikasi Kualitas Udara Yang Aman Untuk Beraktivitas Menggunakan Long Short Term-Memory.

Qing Hong Zou, dkk. (2020). A Water Quality Prediction Method Based On The Multi-time Scale Bidirectional Long Short-Term Memory Network.

Rao, A. dan Spasojevic, N. 2016. Actionable and Political Text Classification using Word Embeddings and LSTM.

Ridho Fariha, Romi Fadhillah Rahmat, Indra Aulia, (2018). Identifikasi Tingkat Kelayakan Hidup Ikan Endemik Danau Toba Berdasarkan Kandungan Air Menggunakan Long Short Term Memory.

Samuel, A. L. (1959). Machine Learning.

Sugiarto, B. and Sustika, R., (2016). Data classification for air quality on wireless sensor network monitoring system using decision tree algorithm. In Science and Technology-Computer (ICST), International Conference on (pp. 172-176). IEEE.

Supardjo, M.N. 2008. :Identifikasi Vegetasi Mangrove Di Segoro Anak Selatan, Taman Nasional Alas Purwo, Banyuwangi Jawa Timur. Jurnal Saintek Perikanan" Vol.03 No.02 2008 : 9-15.

Susanto dan Asriningrum, W. (2012). Penginderaan Jauh dengan Nilai Indeks Faktor Untuk Identifikasi Mangrove di Batam. Jurnal Berita Dirgantara Lapan. Vol 12 No.3 hlm 104-109.

Walter, A., & Barbanti, L. (2001). Temperature, heat content, mixing and stability in Lake Orta: a pluriannual investigation.

Welch, E. B. (1980). Ecological Effects of Waste Water.

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LAPORAN AKHIR
PENELITIAN TALENTA USU
PENELITIAN KOLABORASI INTERNASIONAL

PENGEMBANGAN KERANGKA HUKUM BARU UNTUK PARIWISATA BERBASIS KOMUNITAS DI DANAU TOBA DENGAN KONSEP WISATA HALAL

DEVELOPING A NEW LEGAL FRAMEWORK FOR COMMUNITY-BASED TOURISM IN LAKE TOBA: THE CASE OF HALAL TOURISM

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Maret 2023

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RINGKASAN

Industri Pariwisata merupakan salah satu sumber pendapatan negara yang sangat potensial untuk terus dikembangkan. Salah satu bentuk konkrit pengembangan pariwisata di Indonesia adalah dengan menyediakan wisata halal di setiap destinasi wisata di Indonesia. Wisata halal merupakan konsep pariwisata yang memberikan kemudahan bagi umat muslim untuk tetap menjalankan syariat agamanya selama berwisata. Bentuk konkrit dari implementasi wisata halal ini seperti ketersediaan beberapa infrastruktur pendukung seperti musholla yang bersih, penunjuk arah kiblat, tempat wudhu, restoran halal, hotel syariah, dan infrastruktur lainnya. Adapun tujuan dari penelitian ini adalah (i) Mengetahui perspektif masyarakat di Kawasan Danau Toba khususnya di Kabupaten Toba dan Kabupaten Samosir terkait Wisata Halal; dan (ii) Mengetahui pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal. Penelitian akan dilaksanakan di Sumatera Utara yaitu kawasan Danau Toba khususnya Kabupaten Toba Kabupaten Samosir. Ruang lingkup yang akan diteliti adalah tentang persepsi masyarakat, dalam hal ini pelaku usaha penyedia akomodasi *homestay* dan juga wisatawan di Kabupaten Toba dan Kabupaten Samosir terkait wacana wisata halal. Lebih lanjut, penelitian ini juga akan melihat pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal. Sebagai sebuah penelitian kolaborasi internasional, penelitian ini menggunakan benchmarking wisata halal yang ada di Malaysia. Hal ini didasarkan karena negara tersebut telah mengimplementasikan wisata halal dalam hukum positifnya. Penelitian ini menggabungkan penelitian hukum normatif dan penelitian hukum empiris. Dalam pelaksanaan penelitian hukum normatif, tim peneliti akan melakukan studi literatur dan peraturan perundang-undangan yang berkaitan dengan implementasi wisata halal di Indonesia. Sedangkan pada penelitian empiris, tim peneliti akan melakukan observasi lapangan, wawancara dan Focus Group Discussion (FGD) dengan pemerintah daerah (dinas Pariwisata Provsu, Kab.Toba dan Kab.Samosir), masyarakat yang merupakan pelaku usaha penyedia akomodasi dan wisatawan yang menginap di akomodasi (*homestay*) di Kawasan Danau Toba. Seluruh data yang diperoleh tim dari kegiatan observasi, wawancara, focus group discussion dengan para stakeholders dan studi literatur. Data yang diperoleh akan dianalisis secara kualitatif sehingga diperoleh hasil penelitian yang bersifat deskriptif analitis. Adapun luaran wajib dari penelitian ini adalah publikasi di Jurnal Internasional Terindeks Scopus Q2 serta 1 (satu) buah buku ajar yang menjadi luaran penelitian ini.

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Penelitian ini dapat terlaksana atas kerja sama bantuan dari berbagai pihak. Untuk itu kami mengucapkan terima kasih yang sebesar-besarnya kepada:

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7. Dinas Kebudayaan dan Pariwisata Kabupaten Toba
8. Dinas Kebudayaan dan Pariwisata Kabupaten Samosir
9. Pelaku usaha *homestay* di Kabupaten Simalungun, Kabupaten Toba dan Kabupaten Samosir.

Kami menyadari bahwa dalam pelaksanaan kegiatan ini masih terdapat kekurangan. Sehingga, kami sangat menerima kritik dan saran yang membangun demi kesempurnaan penelitian lanjutan yang akan kami laksanakan di tahun berikutnya.

Medan, 13 April 2023
Ketua Peneliti

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2. Lampiran 2: Draft Artikel 2 berjudul *"The Preliminary Study On A Legal Framework Acceptance Relate To Halal Tourism In Lake Toba"*
3. Lampiran 3: Draft Artikel 3 berjudul "The Comparative Study of Muslim Friendly Homestay Programs in Indonesia and Malaysia: A Social Legal Perspective"
4. Lampiran 4: Outline Buku Ajar

BAB I
PENDAHULUAN

1.1 Latar Belakang

Indonesia merupakan negara yang majemuk. Hal ini dapat dilihat dari penduduk yang terdiri dari berbagai etnis dan agama. Berdasarkan data Badan Pusat Statistik, setidaknya terdapat 1300 lebih suku bangsa di Indonesia yang memeluk berbagai agama yang ada di Indonesia seperti Islam, Kristen, Katholik, Hindu, Budha, Kong Hu Cu, dan Aliran Kepercayaan lainnya.[1] Masing-masing suku bangsa dan agama tersebut memiliki keunikan tersendiri yang membedakan antara satu suku atau agama dengan yang lainya mulai dari tarian, makanan, pakaian, destinasi wisata dan sebagainya yang identik dengan suku bangsa tersebut. Keunikan tersebut menjadi salah satu faktor pendorong wisatawan mancanegara maupun domestik untuk tertarik berwisata di Indonesia.[2] Berdasarkan data dari Badan Pusat Statistik, jumlah wisatwan yang berkunjung ke Indonesia dari tahun 2018-2020 dapat dilihat dalam grafik di bawah ini:[3]

Tabel 1. Data Jumlah Wisatawan tahun 2018 s/d 2020

Tahun	Jumlah Wisatawan
2018	303 403 888
2019	722 158 733
2020	518 588 962

Berdasarkan data tersebut, dapat disimpulkan bahwa jumlah wisatawan di Indonesia setiap tahunnya mencapai ratusan juta orang. Bahkan dalam kondisi awal Pandemi Covid-19 di tahun 2020, jumlah wisatawan di Indonesia menyentuh angka 500 juta orang lebih. Ini membuktikan bahwa industri pariwisata dapat dijadikan sebagai salah satu sumber pendapatan yang potensial bagi Indonesia.

Secara umum, industri Pariwisata merupakan salah satu sumber pendapatan negara yang sangat potensial untuk terus dikembangkan.[4] Melihat data di atas, maka sudah saatnya Indonesia melakukan pengembangan industri pariwisatanya. Salah satu bentuk konkrit pengembangan pariwisata di Indonesia adalah dengan menyediakan wisata halal di setiap destinasi wisata di Indonesia.[5] Wisata halal merupakan konsep pariwisata yang memberikan kemudahan bagi umat muslim untuk tetap menjalankan syariat agamanya selama berwisata.[6] Bentuk konkrit dari implementasi wisata halal ini seperti ketersediaan beberapa infrastruktur pendukung seperti musholla yang bersih, penunjuk arah kiblat, tempat wudhu, restoran halal, hotel syariah, dan infrastruktur lainnya.[7]

Wisata halal memiliki potensi ekonomi yang cukup besar bagi suatu negara termasuk Indonesia. Data dari State Global Islamic Economy Report 2020 – 2021 menyebutkan bahwa Indonesia masuk dalam klasifikasi negara dengan pengeluaran wisata halal mencapai USD

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[1] Badan Pusat Statistik. "*Kewarganegaraan, suku bangsa, agama, dan 1ahasa sehari-hari penduduk Indonesia: Hasil sensus penduduk 2010*." (Jakarta: BPS, 2011). Hal. 5

[2] Muktaf, Z. M., & Zulfiana, E. R. (2018). Persepsi wisatawan asing terhadap wisata indonesia. *Cakrawala Jurnal Penelitian Sosial*, *7*(1), 83-106

[3] https://www.bps.go.id/indicator/16/1189/1/jumlah-perjalanan-wisatawan-nusantara.html diakses pada tanggal 22 April 2022

[4] Seyi Saint Akadiri, Ada Chigozie Akadiri, and Uju Violet Alola. "Is there growth impact of tourism? Evidence from selected small island states." *Current Issues in Tourism*. (2017): 1-19. Hal.1

[5] Elpa, Hermawan, "Strategi Kementerian Pariwisata Indonesia Dalam Meningkatkan Branding Wisata Halal." *Jurnal Ilmu Manajemen dan Akuntansi* 7.2 (2019): 87-95.

[6] Rahardi Mahardika, "Strategi Pemasaran Wisata Halal." *Mutawasith: Jurnal Hukum Islam* 3.1 (2020): 65-86.

[7] Fatwa DSN-MUI Nomor 08/DSN- MUI/X/2016 tentang Pedoman Penyelenggaraan Pariwisata Berdasarkan Prinsip Syariah

11,2 Miliar.[8] Selain itu, pada tahun 2019 berdasarkan pemeringkatan GMTI (Global Muslim Travel Index) yang dipublikasikan Crescent Rating – Mastercard, Indonesia menduduki peringkat pertama negara dengan destinasi wisata halal di dunia. Namun, pada tahun 2021, Indonesia mengalami penurunan peringkat dalam hal destinasi wisata halal, menjadi posisi keempat setelah Malaysia, Turki dan Arab Saudi. Kendati demikian, posisi Indonesia masih lebih baik jika dibandingkan dengan negara-negara Islam besar lainnya seperti Uni Emirat Arab, Qatar, Bahrain, Pakistan, Brunei, Mesir, Kuwait dan negara-negara Islam lainnya.[9]

Keberhasilan Indonesia dalam menempati posisi yang tinggi dalam destinasi halal di dunia tidak terlepas dari peran beberapa provinsi dalam penerapan wisata halal.[10] Adapun beberapa provinsi di Indonesia yang diklaim sudah menerapkan wisata halal tersebut antara lain Nusa Tenggara Barat, Nanggroe Aceh Darussalam, Riau, DKI Jakarta, Sumatera Barat, dan lainnya.[11] Implementasi Hal ini tentunya patut ditiru daerah-daerah lain di Indonesia, khususnya Sumatera Utara.

Sumatera Utara merupakan salah satu provinsi di Indonesia yang memiliki destinasi wisata kelas dunia seperti Danau Toba, Kaldera Geopark Toba, Bukit Lawang, Pulau Mursala, Berastagi, Siosar 2000, Pantai Lagundri di Nias, dan sebagainya.[12] Destinasi wisata kelas dunia tersebut didukung dengan ketersediaan berbagai sarana dan prasarana. Salah satu sarana dan prasarana tersebut adalah akomodasi perhotelan. Kondisi faktual hari ini, terdapat 1412 (seribu empat ratus dua belas) hotel di Sumatera Utara.[13] Berbagai destinasi wisata di Sumatera Utara identik dengan suku batak. Khusus di beberapa kabupaten yang berada di Kawasan Danau Toba seperti Kabupaten Toba dan Kabupaten Samosir.

Sebagai destinasi wisata kelas dunia, wisatwan yang berkunjung ke Danau Toba berasal dari berbagai negara, suku bangsa, dan agama. Berdasarkan data Program Pembangunan Pariwisata Terintegrasi dan Bekelanjutan (P3TB), jumlah wisatwan yang berkunjung ke Kabupaten Toba dan Kabupaten Samosir sebelum pandemi Covid-19 mencapai 951.733 (Sembilan ratus lima puluh satu ribu tujuh ratus tiga puluh tiga) wisatawan.[14] Hal ini menunjukkan tingginya animo wisatawan untuk berkunjung ke Danau Toba.

Sebagai sebuah destinasi wisata, penduduk yang menetap di sekitar Danau Toba merupakan suku Batak Toba. Berdasarkan data yang ditampilkan dalam Data BPS dalam Angka tahun 2020, mayoritas Suku Batak Toba di daerah tersebut beragama Kristen Protestan dan Katholik dengan jumlah sebagai berikut:[15]

Tabel 2. Jumlah Penduduk berdasarkan agama

Agama	Jumlah
Kristen Protestan	270 206
Katholik	21 987
Islam	Data Tidak Tersedia

[8]Dinar Standard, *State of the Global Islamic Economy Report 2020/21*, (Dubai, Salaam Gateway, 2020), hal 99.

[9] https://kominfo.go.id/content/detail/18069/5-tahun-kembangkan-pariwisata-halal-indonesia-akhirnya-raih-peringkat-pertama-wisata-halal-dunia-2019/0/artikel_gpr diakses pada tanggal 10 Maret 2022, bandingkan dengan Global Muslim Travel Index 2021 yang dirilis oleh Crescent Rating, diakses dari https://www.crescentrating.com/reports/global-muslim-travel-index-2021.html, tanggal 19 April 2022.

[10] *Ibid.*

[11] *Ibid*.

[12] https://sumutprov.go.id/artikel/halaman/obyek-wisata diakses pada tanggal 20 April 2020

[13] Badan Pusat Statistik Propinsi Sumatera Utara. *Provinsi Sumatera Dalam Angka 2022.* (Medan: BPS Propinsi Sumatera Utara, 2022) Hal.611

[14] https://p3tb.pu.go.id/in/main/project_location/toba/121/171/168/177 diakses pada tanggal 22 April 2022

[15] https://tobasamosirkab.bps.go.id/statictable/2017/09/28/261/jumlah-umat-beragama-menurut-kecamatan-tahun-2016.html diakses pada tanggal 22 April 2022

Masyarakat Suku Batak Toba dalam kesehariannya tidak dapat terpisahkan dengan hewan ternak seperti babi dan kerbau. Hewan ternak tersebut sering digunakan dalam berbagai upacara adat seperti perkawinan, kematian, dan sebagainya.[16] Selain itu, hewan tersebut juga dijadikan sebagai konsumsi masyarakat sehari-hari yang diolah menjadi kuliner khas seperti babi panggang, saksang, lomok-lomok, dan sebagainya. Selain makanan, masyarakat Suku Batak Toba juga familiar dengan tuak, yaitu sejenis minuman beralkohol yang berasal dari mayang pohon aren.[17] Minuman tersebut juga dikonsumsi dalam kegiatan upacara adat atau dalam kehidupan sehari.hari.[18]

Situasi dan kondisi di kawasan Danau Toba ini menjadi penting untuk diperhatikan mengingat saat ini Indonesia telah memiliki kebijakan kepariwisataan. Pertama, Peraturan Pemerintah Republik Indonesia Nomor 50 Tahun 2011 Tentang Rencana Induk Pembangunan Kepariwisataan Nasional Tahun 2010 – 2025. Kedua, Peraturan Daerah (Perda) No 5 Tahun 2018 Tentang Rencana Induk Pembangunan Kepariwisataan Provinsi Sumatera Utara Tahun 2017-2025. Kedua peraturan ini merupakan pijakan bagi pengembangan kepariwisataan untuk memastikan peningkatan kesejahteraan masyarakat khususnya di wilayah destinasi wisata seperti Danau Toba.

Lebih lanjut, situasi dan kondisi terkait dengan kehidupan keseharian masyarakat lokal ini penting untuk diketahui bahwa pada beberapa wisatawan khususnya wisatawan muslim. Hal ini menjadi penting didasarkan pada makanan dan minuman yang biasa dikonsumsi oleh penduduk lokal ini tidak dapat dikonsumsi dikarenakan adanya larangan dalam ajaran Islam.[19] Oleh karena itu, para stakeholders terkait penyelenggaraan pariwisata di Danau Toba harus mengakomodir kebutuhan wisatawan muslim seperti ketersediaan makanan dan minuman halal. Salah satu bentuk konkrit untuk mengakomodir kebutuhan tersebut adalah dengan mengimplementasikan konsep wisata halal di Danau Toba. Implementasi konsep tersebut dapat diwujudkan dengan menyediakan fasilitas makanan dan minuman yang terjamin kehalalalnnya, ketersediaan tempat ibadah, dan sebagainya.

Berdasarkan observasi awal tim Peneliti ke beberapa destinasi tersebut, konsep wisata halal belum terimplementasi dengan baik. Seperti contoh, di Kawasan Danau Toba yang berpenduduk mayoritas non-muslim, jumlah restoran halal masih sedikit. Tidak hanya ketersediaan restoran halal, tetapi juga fasilitas yang mendukung kenyamanan berwisata bagi wisatawan muslim seperti fasilitas ibadah, hotel syariah, dan kebersihan sanitasi lingkungan. Minimnya sarana dan prasarana tentunya dapat mengurangi ketertarikan wisatawan lokal dan mancanegara khususnya yang beragama Islam untuk datang berkunjung ke Danau Toba yang merupakan salah satu Geopark dunia. Padahal danau toba merupakan bagian dari proyek strategi nasional.[20] Hal ini didukung dengan ketersediaan infrastruktur jalan tol Medan-Tebing Tinggi dan bandar udara dengan penerbangan internasional seperti Bandara Sibisa yang beroperasi di Kabupaten Toba.

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[16] Firman Oktavianus Hutagaol, and Iky Sumarthita P. Prayitno. "Perkembangan Ritual Adat Mangongkal Holi Batak Toba dalam Kekristenan di Tanah Batak." *Anthropos: Jurnal Antropologi Sosial dan Budaya (Journal of Social and Cultural Anthropology)* 6, no. 1 (2020): 84-92. Hal.89

[17] Shigehiro Ikegami. "Tuak dalam Masyarakat Batak Toba. Laporan Singkat tentang Aspek Sosial-Budaya Penggunaan Nira." *Annual Report of the University of Shizuoka. Hamamatsu College* 11-3 (1997). Hal. 1

[18] *Ibid.*

[19] https://www.viva.co.id/gaya-hidup/inspirasi-unik/1420411-bukan-hanya-babi-dan-alkohol-ini-7-jenis-makanan-dan-minuman-haram?page=all&utm_medium=all-page, diunduh pada 27 April 2022

[20] https://kppip.go.id/proyek-strategis-nasional/pariwisata/percepatan-infrastruktur-transportasi-listrik-dan-air-bersih-10-kawasan-strategis-pariwisata-nasional-kspn-prioritas-danau-toba-pulau-seribu-tanjung-lesung-dan-7-kawasan-lainnya/ diakses pada tanggal 19 April 2022

Selanjutnya, terdapat faktor penghambat implementasi wisata halal di Kabupaten Toba dan Kabupaten Samosir. Pertama, adanya pemahaman yang salah oleh para stakeholders di Kabupaten Toba dan Kabupaten Samosir terkait konsep wisata halal, yang dimaknai sebagai upaya Islamisasi.[21] Kedua, belum adanya peraturan daerah pada tingkat provinsi maupun kabupaten/kota tentang wisata halal sebagai tindak lanjut Peraturan Menteri pariwisata dan Ekonomi Kreatif Nomor KM.40/UM.001/MP/2018 tentang Logo Halal Tourism Indonesia dan logo Pariwisata Halal Indonesia.

Berdasarkan uraian di atas, tim berencana melakukan kajian terkait potensi implementasi wisata halal di danau toba. Tim akan bekerja sama dengan tim dari Universiti Teknologi Mara (UiTM) yang melakukan penelitian dengan judul *The Critical Success Factors Towards Community-based Homestay Development in Penang*. Adapun target luaran penelitian ini adalah (i) adanya gagasan mengenai konsep wisata halal; (ii) adanya *roadmap* penerapan wisata halal di Danau Toba kepada Pemerintah Daerah Provinsi Sumatera Utara dan Pemerintah Kabupaten Toba dan Kabupaten Samosir; (iii) publikasi di Jurnal Internasional terindeks Scopus Quartile 2.

1.2 Rumusan Permasalahan

Berdasarkan uraian di atas, adapun permasalahan yang akan menjadi fokus penelitian ini adalah:

1. Bagaimana perspektif masyarakat di Kawasan Danau Toba khususnya di Kabupaten Toba dan Kabupaten Samosir terkait Wisata Halal?
2. Bagaimana pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal?

1.3 Tujuan Khusus

Adapun tujuan dilaksanakannya penelitian ini adalah:

1. Mengetahui perspektif masyarakat di Kawasan Danau Toba khususnya di Kabupaten Toba dan Kabupaten Samosir terkait Wisata Halal.
2. Mengetahui pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal.

1.4 Urgensi Penelitian

Urgensi dilakukannya penelitian ini adalah untuk mengetahui bagaimana perspektif masyarakat di Kawasan Danau Toba khususnya di Kabupaten Toba dan Kabupaten Samosir terkait Wisata Halal di Danau Toba. Di samping itu, penelitian ini juga penting untuk mengetahui pemahaman Pemerintah Daerah (Provinsi Sumatera Utara, Kabupaten Toba dan Kabupaten Samosir) dalam Menyusun Peraturan Daerah tentang Wisata Halal. Adanya peraturan daerah tersebut diharapkan dapat memberikan kepastian hukum dan rasa nyaman bagi para wisatawan Muslim di Danau Toba. Dengan demikian, diharapkan juga hal ini akan berdampak pada peningkatan pendapatan asli daerah Kabupaten Toba dan Kabupaten Samosir.

[21] https://news.detik.com/berita/d-4690578/mahasiswa-pecinta-danau-toba-aksi-tolak-wisata-halal, diakses pada tanggal 15 April 2022

1.5 Rencana Target Luaran

Tabel 3. Target Rencana Luaran

No.	Jenis Luaran	Jumlah	Nama jurnal, Nama Konferensi/ Jenis KI Judul Buku Ajar
	Luaran Wajib		
1.	Publikasi artikel di jurnal internasional	1	Sriwijaya Law Review Scopus Q3
2.	Publikasi artikel di jurnal nasional terakreditasi	-	-
3.	Hak kekayaan intelektual	-	-
4.	Publikasi artikel di prosiding internasional terindeks	-	-
	Luaran Tambahan		
1.	Publikasi artikel di prosiding internasional terindeks	1	CSSPO
2.	Publikasi artikel di prosiding nasional	-	-
3.	Hak kekayaan intelektual	-	-
4.	Produk/TTG/Model/Karya seni	-	-
5.	Buku ajar	1	Hukum Kepariwisataan: Wisata Halal Dalam Teks dan Konteks

BAB II
TINJAUAN PUSTAKA

2.1 Pengertian, Konsep dan Prinsip Wisata Halal

Wisata halal merupakan bentuk pariwisata yang diselenggarakan dengan konsep ramah muslim. Makna dari konsep ramah muslim adalah dengan memastikan bahwa setiap wisatawan yang beragama islam difasilitasi untuk melaksanakan perjalanan wisata yang sesuai dengan prinsip-prinsip syariah.[22] Bentuk konkrit dari penyelenggaraan konsep wisata halal ini dapat berupa:[23]

1. tersedianya musholla yang bersih dan terhindar dari najis;
2. tersedianya penunjuk arah kiblat yang memudahkan wisatwan untuk melaksanakan shalat 5 (lima) waktu;
3. tersedianya tempat wudhu yang bersih dan berfungsi dengan baik;
4. tersedianya restoran halal atau petunjuk yang dapat memberikan informasi terkait makanan dan minuman halal dan non-halal;
5. tersedianya hotel syariah yang menghindarkan wisatawan dengan hal-hal berbau maksiat;
6. penyediaan pertunjukan seni dan budaya serta atraksi yang tidak bertentangan dengan kriteria umum pariwisata syariah;
7. mengimplementasikan kebersihan sanitasi lingkungan, dan sebagainya.

Selanjutnya, Dewan Syariah Nasional – Majelis Ulama Indonesia[24] mengeluarkan Fatwa DSN-MUI Nomor 08/DSN- MUI/X/2016 tentang Pedoman Penyelenggaraan Pariwisata Berdasarkan Prinsip Syariah ("FATWA DSN-MUI No.08/2016"). Penting untuk dipahami bahwa fatwa tersebut bukanlah hukum positif yang berlaku di Indonesia dan tidak mengikat secara umum. Akan tetapi, substansi dari Fatwa tersebut dapat dijadikan referensi bagi para pelaku usaha yang akan mengimplementasikan wisata halal di suatu daerah serta pemerintah daerah. Fatwa tersebut menentukan serangkaian indikator terkait dengan wisata halal sebagai berikut:[25]

1. Wisata halal diselenggarakan dengan prinsip yang dapat menghindarkan wisatawan dari hal-hal yang berbau kemusyrikan, kemaksiatan, tabdzir/israf, kamafsadatan, dan kemungkaran. Penyelenggaraan wisata halal harus mampu menciptakan kemaslahatan dan kemanfaatan kepada berbagai pihak secara materil dan spiritual;
2. Pihak-pihak yang terkait dengan wisata halal terdiri dari wisatawan, Biro Perjalanan Wisata Syariah (BWPS), Pengusaha Pariwisata, Hotel Syariah, Pemandu Wisata, Terapis, dan pihak lainnya yang terikat dalam beberapa akad.
3. Pelaku usaha dibidang hotel syariah, harus memenuhi ketentuan khusus yang ditentukan oleh MUI;
4. Wisatawan yang berwisata di tempat yang sudah menerapkan wisata halal harus mematuhi ketentuan-ketentuan tentang syariah;
5. Pengelola spa, sauna dan massage yang menerapkan prinsip syariah dalam menjalankan kegiatan usahanya;
6. Biro Perjalanan Wisata Syariah wajib memenuhi ketentuan-ketentuan syariah yang telah ditentukan oleh MUI;

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[22] Alwafi Ridho Subarkah. "Potensi dan prospek wisata halal dalam meningkatkan ekonomi daerah (studi kasus: Nusa Tenggara Barat)." *Jurnal Sosial Politik* 4, no. 2 (2018): 49-72. Hal.51

[23] *Ibid.*

[24] Peraturan Presiden Nomor 151 Tahun 2014 Tentang Bantuan Pendanaan Kegiatan Majelis Ulama Indonesia menyatakan bahwa MUI adalah wadah musyawarah para ulama, pemimpin dan cendekiawan muslim dalam mengayomi umat dan mengembangkan kehidupan yang Islami serta meningkatkan partisipasi umat Islam dalam pembangunan nasional.

[25] Fatwa DSN-MUI Nomor 08/DSN- MUI/X/2016 tentang Pedoman Penyelenggaraan Pariwisata Berdasarkan Prinsip Syariah

7. Pemandu wisata syariah wajib memenuhi ketentuan-ketentuan syariah yang telah ditentukan oleh MUI;
8. Pemerintah daerah atau badan otorita yang mengelola destinasi wisata tersebut harus memastikan beberapa hal terkait dengan sarana dan prasarana di destinasi wisata tersedia dan dapat dimanfaatkan dengan baik.

Meskipun Fatwa tersebut tidak menjadi hukum positif di Indonesia,[26] beberapa Peraturan Daerah di Indonesia menjadikan fatwa tersebut sebagai salah satu referensi dalam penyusunannya. Oleh karena itu, indikator-indikator tersebut dapat dijadikan sebagai panduan bagi para stakeholders penyelenggara pariwisata di Danau Toba dalam menyusun konsep wisata halal yang dapat diterapkan di Danau Toba.

2.2 Kondisi Faktual Wisata Halal di Indonesia

Hingga hari ini, terdapat beberapa peraturan perundang-undangan yang dapat dijadikan sebagai rujukan dalam implementasi wisata halal di Indonesia. Adapun peraturan perundang-undangan tersebut antara lain:

1. Undang-Undang Kepariwisataan Nomor 10 Tahun 2009 tentang Kepariwisataan
2. Peraturan Pemerintah Nomor 50 Tahun 2011 tentang Rencana Induk Pembangunan Kepariwisataan Nasional 2010 – 2025
3. Peraturan Menteri Pariwisata dan Ekonomi Kreatif Nomor Peraturan Menteri Pariwisata dan Ekonomi Kreatif Nomor 2 Tahun 2014 tentang Pedoman Penyelenggaraan Usaha Hotel Syariah
4. Peraturan Gubernur Nusa Tenggara Barat Nomor 51 Tahun 2015 tentang Wisata Halal
5. Peraturan Daerah Provinsi Sumatera barat Nomor 1 Tahun 2020 tentang Penyelenggaraan Pariwisata Halal
6. Fatwa DSN-MUI Nomor 08/DSN- MUI/X/2016 tentang Pedoman Penyelenggaraan Pariwisata Berdasarkan Prinsip Syariah.

Keberadaan pengaturan hukum tentang wisata halal yang dimiliki oleh pemerintah belum mampu menjamin implementasi wisata halal. Kondisi ini terlihat di Sumatera Utara, khususnya Kawasan wisata Danau Toba yang berada dalam 7 wilayah kabupaten yaitu Samosir, Toba, Tapanuli Utara, Dairi, Simalungun, Karo dan Humbang Hasundutan. daerah mendapat penolakan.[27] Hal ini dikarenakan adanya mispersepsi terkait konsep wisata halal. Padahal implementasi konsep pariwisata tersebut tentunya dapat memberikan beberapa manfaat seperti peningkatan Pendapatan Asli Daerah (PAD), peningkatan jumlah investasi di bidang pariwisata, serta akan menciptakan lapangan pekerjaan baru di daerah tersebut.[28]

Sumatera Utara dapat mencontoh Propinsi Nusa Tenggara Barat (NTB) sebagai salah satu propinsi yang telah mengimplementasikan wisata halal melalui Peraturan Gubernur Nusa Tenggara Barat Nomor 51 Tahun 2015 tentang Wisata Halal ("Pergub NTB No.51/2015"). Peraturan tersebut menjadi referensi bagi setiap stakeholders di bidang pariwisata apabila ingin mengimplementasikan wisata halal di Propinsi NTB. Hal ini tentunya berdampak positif baik bagi jumlah wisatawan yang berwisata ke Propinsi NTB. Sebagai informasi, pada tahun 2021 (saat Pandemi Covid-19), jumlah wisatawan yang berkunjung ke NTB berjumlah 964.036 (sembilan ratus enam puluh empat ribu tiga puluh enam) orang wisawatan.[29] Dampak positif

[26] https://www.hukumonline.com/klinik/a/kedudukan-fatwa-mui-dalam-hukum-indonesia-lt5837dfc66ac2d, diunduh pada 27 April 2022

[27] https://www.cnnindonesia.com/gaya-hidup/20190904205123-269-427610/edy-rahmayadi-respons-polemik-wisata-halal-di-danau-toba, diunduh pada 20 April 2022 pukul 13.33

[28] Eka Dewi Satriana and Hayyun Durrotul Faridah. "Wisata halal: perkembangan, peluang, dan tantangan." *Journal of Halal Product and Research (JHPR) Vol* 1, no. 02 (2018): 32-43. Hal.33

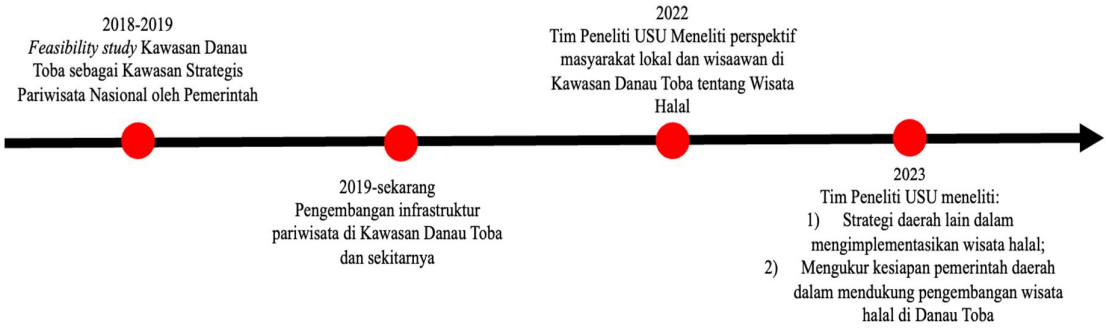
[29] https://data.ntbprov.go.id/dataset/jumlah-kunjungan-wisatawan-ke-provinsi-nusa-tenggara-barat-ntb diakses pada tanggal 20 April 2022

lainnya adalah pengembangan infrastruktur pariwisata di daerah tersebut seperti pembangunan Kawasan Ekonomi Khusus Mandalika, Pengembangan Geopark Rinjani dan Tambora, dan sebagainya. Strategi yang dilakukan NTB dalam pengembangan wisata halal adalah dengan bekerjasama dengan MUI, LPPOM dan Dinas Kebudayaan, Pariwisata dan UMKM melaksanakan sertifikasi halal terhadap restoran yang ada di hotel atau di luar hotel, rumah makan, dan pelaku usaha UMKM.[30]

2.3 Penelitian Terdahulu

Berdasarkan penelusuran ke berbagai literatur, terdapat beberapa penelitian yang membahas wisata halal di Danau Toba. Namun, fokus penelitian tersebut berbeda dengan penelitian ini. Penelitian ini akan berfokus pada perspektif masyarakat lokal, pelaku usaha dan wisatawan di Kawasan Danau Toba terkait implementasi wisata halal di daerah tersebut dan kesiapan pemerintah daerah untuk mengimplementasikan konsep wisata halal di danau toba. Oleh karena itu, dapat disimpulkan bahwa isu yang diangkat dalam penelitian ini adalah isu baru yang sama sekali belum dibahas oleh siapapun.

2.4 Road Map Penelitian



Gambar 1: Road Map Penelitian

[30] Eka Dewi Satriana. *Op.Cit.* Hal.35

BAB III
METODE PENELITIAN

3.1 Lokasi dan Ruang Lingkup Penelitian

Penelitian akan dilaksanakan di Sumatera Utara yaitu kawasan Danau Toba khususnya Kabupaten Simalungun, Kabupaten Toba dan Kabupaten Samosir. Ruang lingkup yang akan diteliti adalah tentang persepsi masyarakat, dalam hal ini pelaku usaha penyedia akomodasi *homestay* dan juga wisatawan di Kabupaten Simalungun, Kabupaten Toba dan Kabupaten Samosir terkait wacana wisata halal. Lebih lanjut, penelitian ini juga akan melihat pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Simalungun, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal. Sebagai sebuah penelitian kolaborasi internasional, penelitian ini menggunakan benchmarking wisata halal yang ada di Malaysia. Hal ini didasarkan karena negara tersebut telah mengimplementasikan wisata halal dalam hukum positifnya.

3.2 Metode Penelitian

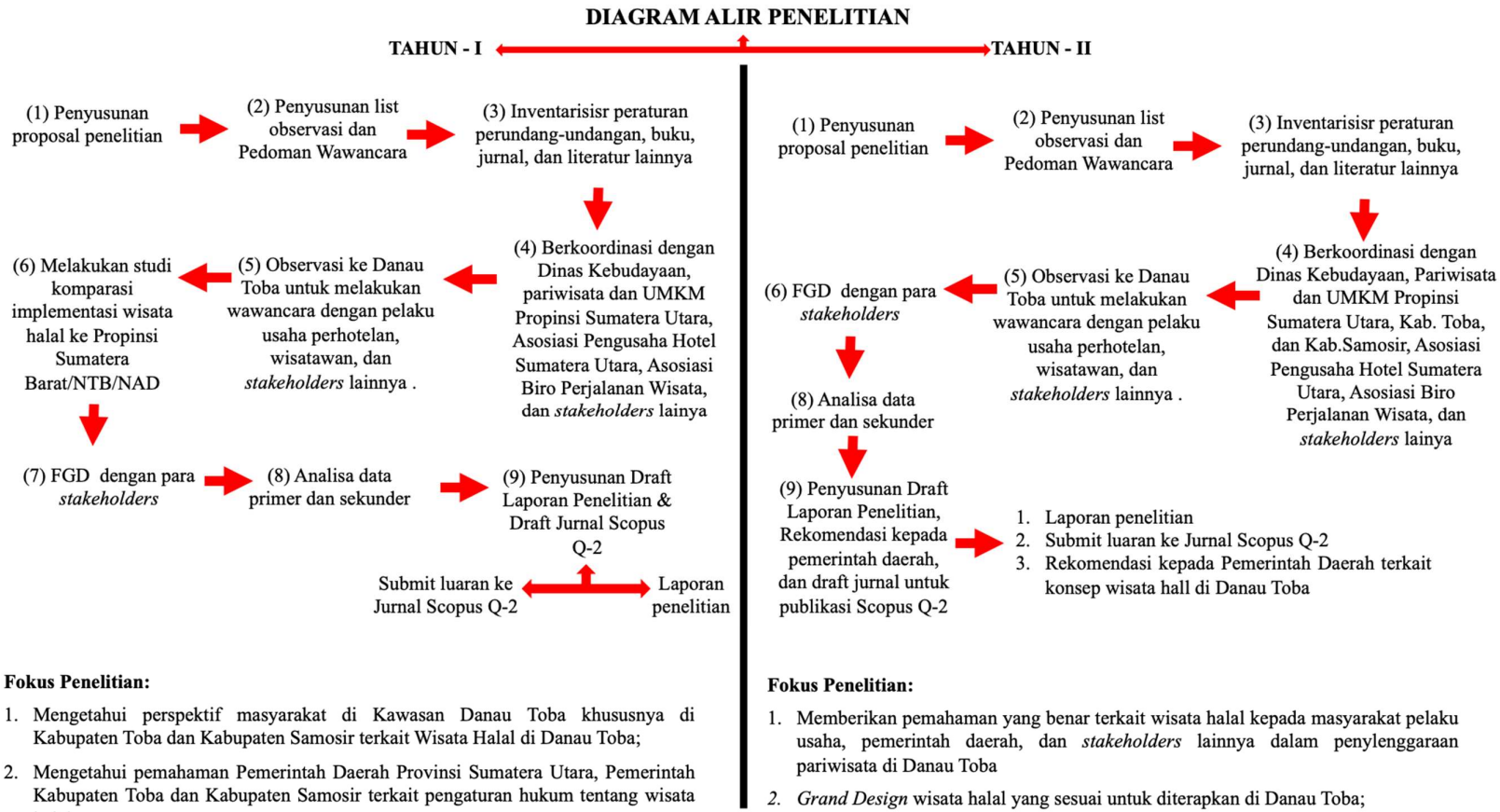
Penelitian ini menggabungkan penelitian hukum normatif dan penelitian hukum empiris. Dalam pelaksanaan penelitian hukum normatif, tim peneliti akan melakukan studi literatur dan peraturan perundang-undangan yang berkaitan dengan implementasi wisata halal di Indonesia.[31] Sedangkan pada penelitian empiris, tim peneliti akan melakukan observasi lapangan, wawancara dan *Focus Group Discussion* (FGD) dengan pemerintah daerah (dinas Pariwisata Provsu, Kab. Simalungun, Kab.Toba dan Kab.Samosir), masyarakat yang merupakan pelaku usaha penyedia akomodasi dan wisatawan yang menginap di akomodasi (*homestay*) di Kawasan Danau Toba.

3.3 Analisis Data

Seluruh data yang diperoleh tim dari kegiatan observasi, wawancara, *focus group discussion* dengan para stakeholders dan studi literatur. Data yang diperoleh akan dianalisis secara kualitatif sehingga diperoleh hasil penelitian yang bersifat deskriptif analitis. Hal ini bertujuan untuk mendapatkan gambaran perspektif masyarakat lokal, pelaku usaha dan wisatawan di Danau Toba terkait penerimaan implementasi wisata halal di daerah tersebut serta kesiapan pemerintah daerah untuk mengimplementasikan konsep wisata tersebut.

[31] Soerjono Soekanto dan Sri Mamudji, *Penelitian Hukum Normatif Suatu Tinjauan Singkat*(Jakarta : PT Raja Grafindo persada, 2006) Hal.1

3.4. Diagram Alir Penelitian



Fokus Penelitian:

1. Mengetahui perspektif masyarakat di Kawasan Danau Toba khususnya di Kabupaten Toba dan Kabupaten Samosir terkait Wisata Halal di Danau Toba;
2. Mengetahui pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal.

Fokus Penelitian:

1. Memberikan pemahaman yang benar terkait wisata halal kepada masyarakat pelaku usaha, pemerintah daerah, dan *stakeholders* lainnya dalam penylenggaraan pariwisata di Danau Toba
2. *Grand Design* wisata halal yang sesuai untuk diterapkan di Danau Toba;

3.4 Susunan Organisasi Tim Pengusul dan Pembagian Tugas

No	Nama /NIDN / NIP	Fakultas / Unit	Bidang Ilmu	Uraian Tugas
1.	Prof. Dr. Ningrum Natasya Sirait., SH., MLI / 0017016203 /	Hukum	Hukum Internasional / Hukum Ekonomi	1) Menyusun proposal Penelitian 2) Menyusun insturmen Penelitian 3) Melakukan Penelitian (data dan lapangan) 4) Melakukan analisa hasil penelitian 5) Menyusun laporan kemajuan dan akhir Penelitian 6) Melakukan diseminasi hasil Penelitian nasional dan internasional. 7) Mengikuti Monev Penelitian
2.	Dr. Rosmalinda., SH., LLM / 0006107408	Hukum	Hukum Internasional	1) Membantu Menyusun proposal Penelitian 2) Melatih Peneliti lapangan untuk menggunakan instrumen Penelitian 3) Melakukan Penelitian (data dan lapangan) 4) Memonitoring pengumpulan data penelitian 5) Membantu menyusun laporan kemajuan dan akhir Penelitian 6) Membantu diseminasi hasil penelitian (Lokal, nasional dan Internasional 7) Mengikuti Monev Penelitian 8) Mengelola Tim Teknis Penelitian.
3.	Dr. Robert, S.H., M.H. / 0013079201	Hukum	Hukum Ekonomi	1) Membantu Menyusun proposal Penelitian 2) Melakukan Penelitian (data dan lapangan) 3) Melakukan analisa hasil penelitian 4) Membantu Menyusun laporan kemajuan dan akhir Penelitian 5) Mengikuti Monev Penelitian

4.	Cheryl Patriana Yuswar, S.H., LL.M. / 0002019005	Hukum	Hukum Perdata	1) Membantu Menyusun proposal Penelitian 2) Melakukan Penelitian (data dan lapangan) 3) Melakukan analisa hasil penelitian 4) Membantu Menyusun laporan kemajuan dan akhir Penelitian 5) Mengikuti Monev Penelitian
5.	M. Hadyan Yunhas Purba, S.H., M.H. / 0027049401	Hukum	Hukum Perdata	1) Membantu Menyusun proposal Penelitian 2) Melakukan Penelitian (data dan lapangan) 3) Melakukan analisa hasil penelitian 4) Membantu Menyusun laporan kemajuan dan akhir Penelitian 5) Mengikuti Monev Penelitian
6.	Lesly Saviera, S.H., M.H. / 0016038709	Hukum	Hukum Ekonomi	1) Membantu Menyusun proposal Penelitian 2) Melakukan Penelitian (data dan lapangan) 3) Melakukan analisa hasil penelitian 4) Membantu Menyusun laporan kemajuan dan akhir Penelitian 5) Mengikuti Monev Penelitian

BAB IV
HASIL DAN PEMBAHASAN

4.1 Perspektif Masyarakat Kawasan Danau Toba di Kabupaten Simalugun, Kabupaten Toba dan Kabupaten Samosir Terkait Wisata Halal

Kawasan Danau Toba khususnya di Kabupaten Simalungun, Kabupaten Toba, dan Kabupaten Samosir mayoritas penduduknya beragama Kristen dan Katholik. Berdasarkan data yang ditampilkan dalam Data BPS dalam Angka tahun 2020, mayoritas masyarakat di kawasan tersebut memeluk agama Kristen Protestan dan Katholik dengan jumlah perbandingan sebagai berikut:[32]

Tabel 4. Jumlah Penduduk berdasarkan agama

Agama	Jumlah
Kristen Protestan	270 206
Katholik	21 987
Islam	Data Tidak Tersedia

Masyarakat yang tinggal di Kawasan Danau Toba terdiri dari beberapa suku seperti Suku Batak Toba, Suku Batak Simalungun, Suku Karo, Suku Batak Pakpak, dansebagainya. Dalam aktifitas keseharian suku-suku tersebut tidak dapat terpisahkan dengan hewan ternak seperti babi dan kerbau. Hewan ternak tersebut sering digunakan dalam berbagai upacara adat seperti perkawinan, kematian, dan sebagainya.[33] Selain itu, hewan tersebut juga dijadikan sebagai konsumsi masyarakat sehari-hari yang diolah menjadi kuliner khas seperti babi panggang, saksang, lomok-lomok, dan sebagainya. Selain makanan, masyarakat Suku Batak Toba juga familiar dengan tuak, yaitu sejenis minuman beralkohol yang berasal dari mayang pohon aren.[34] Minuman tersebut juga dikonsumsi dalam kegiatan upacara adat atau dalam kehidupan sehari-hari.[35] Situasi dan kondisi terkait dengan kehidupan keseharian masyarakat lokal ini penting untuk diketahui bahwa pada beberapa wisatawan khususnya wisatawan muslim. Hal ini menjadi penting didasarkan pada makanan dan minuman yang biasa dikonsumsi oleh penduduk lokal ini tidak dapat dikonsumsi dikarenakan adanya larangan dalam ajaran Islam.[36] Oleh karena itu, para stakeholders terkait penyelenggaraan pariwisata di Danau Toba harus mengakomodir kebutuhan wisatawan muslim seperti ketersediaan makanan dan minuman halal. Salah satu bentuk konkrit untuk mengakomodir kebutuhan tersebut adalah dengan mengimplementasikan konsep wisata halal di Danau Toba. Implementasi konsep tersebut dapat diwujudkan dengan menyediakan fasilitas makanan dan minuman yang terjamin kehalalalnnya, ketersediaan tempat beribadah bagi wisatawan muslim seperti mushola, tempat wudhu, dan sebagainya.

Sebagai masyarakat yang tinggal di daerah destinasi tujuan wisata prioritas, sebagian besar masyarakat di Kawasan Danau Toba menyadari hal tersebut. Bukti nyata kesadaran mereka dapat dilihat dari beberapa tindakan seperti (i) pelaku usaha yang membuka usaha *homestay* memasang tanda arah kiblat dan sajadah di setiap kamar meskipun pemilik usaha

[32] https://tobasamosirkab.bps.go.id/statictable/2017/09/28/261/jumlah-umat-beragama-menurut-kecamatan-tahun-2016.html diakses pada tanggal 22 April 2022

[33] Firman Oktavianus Hutagaol, and Iky Sumarthita P. Prayitno. "Perkembangan Ritual Adat Mangongkal Holi Batak Toba dalam Kekristenan di Tanah Batak." *Anthropos: Jurnal Antropologi Sosial dan Budaya (Journal of Social and Cultural Anthropology)* 6, no. 1 (2020): 84-92. Hal.89

[34] Shigehiro Ikegami. "Tuak dalam Masyarakat Batak Toba. Laporan Singkat tentang Aspek Sosial-Budaya Penggunaan Nira." *Annual Report of the University of Shizuoka. Hamamatsu College* 11-3 (1997). Hal. 1

[35] *Ibid.*

[36] https://www.viva.co.id/gaya-hidup/inspirasi-unik/1420411-bukan-hanya-babi-dan-alkohol-ini-7-jenis-makanan-dan-minuman-haram?page=all&utm_medium=all-page, diunduh pada 27 April 2022

homestay beragama non-muslim; (ii) pelaku usaha menawarkan makanan untuk sarapan pagi yang dipesan dari penjual makanan yang bergama islam; (iii) pelaku usaha memisahkan peralatan masak pribadi dan peralatan memasak yang digunakan oleh tamu *homestay* dan sebagainya. Secara tidak langsung, hal ini menunjukkan bahwa sebagian besar pelaku usaha di Kawasan Danau Toba memiliki kesadaran terkait dengan hal-hal yang kebutuhan wisatawan yang beragama islam selama berwisata di daerah tersebut. Meskipun tidak semua sarana dan prasarana seperti yang disebutkan di dalam FATWA DSN-MUI No.08/2016 disediakan oleh pelaku usaha, akan tetapi kebutuhan dasar yang dibutuhkan wisatawan yang beragama islam untuk menjalankan kewajiban syariatnya seperti sholat, mengonsumsi makanan dan minuman yang halal dan sebagainya selama berwisata dapat dilaksanakan dengan baik.

Selanjutnya, terkait dengan implementasi kebijakan wisata halal atau pelabelan Kawasan Danau Toba sebagai destinasi wisata halal, mayoritas pelaku usaha keberatan dengan hal tersebut. Hal ini dikarenakan istilah "halal" identik dengan agama islam. Sehingga, penggunaan istilah wisata halal di Danau Toba dimaknai sebagai upaya islamisasi di Danau Toba. Hal ini tentunya mendapat berbagai penolakan tidak hanya dari pelaku usaha namun juga masyarakat lokal. Selain itu, wacana penerapan wisata halal di Danau Toba pada tahun 2018 sempat menimbulkan polemik dan kesalahpahaman ditengah masyarakat. Wisata halal dimaknai sebagai upaya islamisasi Danau Toba dengan melarang keberadaan ternak babi di Kawasan Danau Toba dan hal-hal lainnya yang bertentangan dengan syariat Islam. Hal ini menimbulkan kemarahan oleh masyarakat lokal yang mayoritas berasal dari suku Batak dan beragama Kristen dan Katolik yang dalam keseharian maupun adat istiadat tidak bisa dipisahkan dari hal-hal tersebut. Padahal konsep wisata halal sangat jauh berbeda dari apa yang dibayangkan termasuk Islamisasi. Implementasi wisata halal seyogyanya hanya terbatas pada penyediaan fasilitas yang dibutuhkan oleh wisatawan muslim untuk beribadah selagi berwisata. Seiring berjalan waktu, saat ini di tahun 2022 sebagian masyarakat lokal danau toba khususnya yang menjadi pelaku usaha mulai memahami konsep wisata halal dan perlahan sudah menerapkan dalam kegiatan usahanya. Namun, mayoritas masyarakat dan pelaku usaha di Kawasan Danau Toba masih keberatan dengan penggunaan istilah wisata halal. Sebagai alternatif, penggunaan istilah *moslem friendly tourism* dapat digunakan untuk melabeli pariwisata di Danau Toba yang ramah dengan wisatawan muslim. Akan tetapi, masih ada beberapa pelaku usaha yang kontra dengan penggunaan istilah tersebut karena dianggap tidak ada bedanya dengan istilah wisata halal. Mayoritas masyarakat lokal khususnya pelaku usaha lebih setuju agar Kawasan Danau Toba tidak dilabeli dengan istilah-istilah yang condong ke agama manapun. Khusus wisata halal, pelaku usaha lebih sepakat bahwa implementasi konsep wisata halal pada *homestay* dan bidang usaha lainnya menjadi urusan masing-masing pelaku usaha. Pemerintah cukup memberikan edukasi dan pedoman agar pelaku usaha dapat mengetahui bagaimana konsep wisata halal sehingga pelaku usaha dapat mengimplementasikan hal tersebut dengan baik.

Berdasarkan hal-hal tersebut di atas, apabila pemerintah serius ingin mengembangkan wisata halal di Danau Toba, maka seyogyanya pemerintah harus melakukan edukasi mengenai konsep wisata halal kepada pelaku usaha. Hal ini bertujuan agar masyarakat dan pelaku usaha dapat memahami makna dari wisata halal dengan benar. Sehingga, tidak ada lagi kesalahpahaman mengenai konsep wisata halal yang berpotensi merusak kerukunan dan keharmonisan umat bergama di wilayah tersebut. Jika masyarakat sudah diberikan pemahaman dengan baik mengenai konsep wisata halal dan dilakukan *soft approach* yang dibarengi dengan adanya aturan yang jelas terkait hal tersebut, mungkin masyarakat dan pelaku usaha di Kawasan Danau Toba dapat menerima dengan pelabelan wisata halal di Danau Toba.

Berdasarkan wawancara yang telah dilakukan dengan beberapa pelaku usaha *homestay* di kawasan tersebut, penyuluhan yang dilakukan pemerintah kepada pelaku usaha hanya sebatas mengenai kesadaran pariwisata dan bagaimana pelayanan kepada wisatawan secara umum dan tidak pernah secara spesifik membahas terkait dengan wisata halal. Seharusnya, dalam setiap kegiatan penyuluhan dan pembinaan yang dilakukan pemerintah kepada pelaku usaha, materi kegiatan tersebut juga memuat edukasi mengenai wisata halal. Sehingga, apabila pemahaman masyarakat dan pelaku usaha mengenai wisata halal sudah seragam, tentu implementasi wisata halal dapat dilakukan dengan mudah karena pelaku usaha sudah memahami dengan baik mengenai konsep pariwisata tersebut. Selain itu, penting juga dilakukan kemitraan antara pelaku usaha *homestay* dengan pelaku usaha hotel berbintang. Hal ini bertujuan untuk mewujudkan *sharing of knowledge* mengenai tata kelola *homestay* menjadi lebih baik lagi baik dari aspek manajerial, marketing, pembukuan, termasuk juga *hospitality* kepada wisatawan yang berkunjung ke Kawasan Danau Toba.

4.2 Pemahaman Pemerintah Daerah Provinsi Sumatera Utara, Pemerintah Kabupaten Simalungun, Pemerintah Kabupaten Toba dan Kabupaten Samosir terkait pengaturan hukum tentang wisata halal

Tim peneliti telah melaksanakan *Focus Group Dicussion* (FGD) pada Hari Selasa, tanggal 22 Nopember 2022 secara daring. FGD ini diikuti oleh Dinas Kebudayaan dan Pariwisata Propinsi Sumatera Utara, Dinas Kebudayaan dan Pariwisata Kabupaten Simalungun, Dinas Kebudayaan dan Pariwisata Kabupaten Toba dan Dinas Kebudayaan dan Pariwisata Kabupaten Samosir. Berdasarkan hasil FGD tersebut, seluruh Dinas Kebudayaan dan Pariwisata di tingkat propinsi dan kabupaten yang berada di Kawasan Danau Toba mengetahui bagaimana konsep wisata halal. Namun, sosialisasi terkait dengan implementasi wisata halal di Kawasan Danau

BAB VI
KESIMPULAN

Berdasarkan hasil penelitian yang dilakukan, tim peneliti menyimpulkan beberapa hal sebagai berikut:

1. Sebagian besar masyarakat khususnya pelaku usaha *homestay* di Kawasan Danau Toba menyadari kebutuhan wisata muslim selama berwisata di Kawasan tersebut yang mayoritas penduduknya beragama non-muslim. Hal ini dapat dilihat dari beberapa tindakan seperti (i) tersedianya arah kiblat dan sajadah pada setiap kamar meskipun pemilik usaha *homestay* beragama non-muslim; (ii) pelaku usaha menyediakan makanan untuk sarapan pagi dari penjual makanan yang bergama islam; (iii) adanya pemisahan peralatan masak pribadi dan peralatan memasak yang digunakan oleh tamu *homestay* dan sebagainya. Namun, mayoritas pelaku usaha kebertan jika Kawasan Danau Toba dilabeli sebagai pariwisata halal karena istilah tersebut sangat condong ke salah satu agama tertentu;
2. Pemerintah daerah yang Dalam hal ini direpresentasikan oleh Dinas Kebudayaan dan Pariwisata propinsi dan kabupaten di Kawasan Danau Toba memahami bagaimana konsep wisata halal harus dijalankan. Namun, ketiadaan regulasi serta pedoman bagaimana wisata halal diimplementasikan menunjukkan bahwa pengembangan wisata halal bukanlah suatu prioritas bagi pemerintah. Hal ini mengakibatkan sosialisasi wisata halal melalui kegiatan penyuluhan dan pembinaan kepada pelaku usaha *homestay* tidak pernah dilakukan. Dampak dari hal ini adalah banyak pelaku usaha *homestay* yang menolak konsep wisata halal karena berpandangan bahwa wisata halal identik dengan islamisasi.

DAFTAR PUSTAKA

Buku

Standard, Dinar. 2020. State of the Global Islamic Economy Report 2020/21.Dubai: Salaam Gateway

Soekamto , Soerjono dan Sri Mamudji. 2006. Penelitian Hukum Normatif Suatu Tinjauan Singkat. Jakarta : PT Raja Grafindo Persada.

Jurnal

Elpa, Hermawan, "Strategi Kementerian Pariwisata Indonesia Dalam Meningkatkan Branding Wisata Halal." Jurnal Ilmu Manajemen dan Akuntansi 7.2 (2019): 87-95.

Mahardika, Rahardi. "Strategi Pemasaran Wisata Halal." Mutawasith: Jurnal Hukum Islam 3.1 (2020): 65-86.

Muktaf, Z. M., & Zulfiana, E. R. (2018). Persepsi wisatawan asing terhadap wisata indonesia. Cakrawala Jurnal Penelitian Sosial, 7(1), 83-106

Subarkah, Alwafi Ridho. "Potensi dan prospek wisata halal dalam meningkatkan ekonomi daerah (studi kasus: Nusa Tenggara Barat)." Jurnal Sosial Politik 4, No. 2 (2018): 49-72.

Saint Akadiri, Seyi, Ada Chigozie Akadiri, and Uju Violet Alola. "Is there growth impact of tourism? Evidence from selected small island states." Current Issues in Tourism. (2017): 1-19.

Satriana, Eka Dewi, and Hayyun Durrotul Faridah. "Wisata halal: perkembangan, peluang, dan tantangan." Journal of Halal Product and Research (JHPR) Vol 1, no. 02 (2018): 32-43.

Wahidati, Lufi, and Eska Nia Sarinastiti. "Perkembangan Wisata Halal Di Jepang." Jurnal Gama Societa 1, no. 1 (2018): 9-19.

Peraturan Perundang-Undangan

Undang-Undang Kepariwisataan Nomor 10 Tahun 2009 tentang Kepariwisataan

Peraturan Pemerintah Nomor 50 Tahun 2011 tentang Rencana Induk Pembangunan Kepariwisataan Nasional 2010 – 2025

Peraturan Menteri Pariwisata dan Ekonomi Kreatif Nomor Peraturan Menteri Pariwisata dan Ekonomi Kreatif Nomor 2 Tahun 2014 tentang Pedoman Penyelenggaraan Usaha Hotel Syariah

Peraturan Daerah (Perda) No 5 Tahun 2018 Tentang Rencana Induk Pembangunan Kepariwisataan Provinsi Sumatera Utara Tahun 2017-2025

Peraturan Gubernur Nusa Tenggara Barat Nomor 51 Tahun 2015 tentang Wisata Halal

Peraturan Daerah Provinsi Sumatera barat Nomor 1 Tahun 2020 tentang Penyelenggaraan

Internet

https://www.antaranews.com/berita/2264130/potensi-wisata-halal-indonesia-dipaparkan-di-konferensi-internasional diakses pada tanggal 10 Maret 2022

https://kominfo.go.id/content/detail/18069/5-tahun-kembangkan-pariwisata-halal-indonesia-akhirnya-raih-peringkat-pertama-wisata-halal-dunia-2019/0/artikel_gpr diakses pada tanggal 10 Maret 2022

https://news.detik.com/berita/d-4690578/mahasiswa-pecinta-danau-toba-aksi-tolak-wisata-halal diakses pada tanggal 15 April 2022

https://www.halalgourmet.jp/ diakses pada tanggal 18 April 2022

https://kppip.go.id/proyek-strategis-nasional/pariwisata/percepatan-infrastruktur-transportasi-listrik-dan-air-bersih-10-kawasan-strategis-pariwisata-nasional-kspn-prioritas-

danau-toba-pulau-seribu-tanjung-lesung-dan-7-kawasan-lainnya/ diakses pada tanggal 19 April 2022

https://www.crescentrating.com/reports/global-muslim-travel-index-2021.html, tanggal 19 April 2022.

https://sumutprov.go.id/artikel/halaman/obyek-wisata diakses pada tanggal 20 April 2020

https://data.ntbprov.go.id/dataset/jumlah-kunjungan-wisatawan-ke-provinsi-nusa-tenggara-barat-ntb diakses pada tanggal 20 April 2022

Integrated Tourism Master Plan For Lake Toba, https://bpiw.pu.go.id/uploads/itmp/Konsep_Pengembangan_Wilayah_dan_Infrastruktur_KSPN_Danau_Toba.pdf diakses pada tanggal 20 April 2022

https://www.viva.co.id/gaya-hidup/inspirasi-unik/1420411-bukan-hanya-babi-dan-alkohol-ini-7-jenis-makanan-dan-minuman-haram?page=all&utm_medium=all-page, diakses pada 27 April 2022

Lain-Lain

Fatwa DSN-MUI Nomor 08/DSN- MUI/X/2016 tentang Pedoman Penyelenggaraan Pariwisata Berdasarkan Prinsip Syariah

LAMPIRAN I: ARTIKEL KE -1

Partnership Development between Luxury Hotels and Homestay Entrepreneurs in Increasing Lake Toba Community Economic Growth and Tourism Development

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Revised Date: *date (Please leave blank)
Published Date: (Please leave blank)

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ABSTRACT

Homestays commonly developed among Micro Small and Medium (MSMEs) in the tourism sector. Homestay provides tourist opportunities to experience the way of life of the local suburban or urban community. The field study on homestays in Malaysia provided an in-depth data on the challenges and benefits of homestay industry development to the local community welfare and economic status. Additionally, the government aided and assisted homestay experience had contributed to the development of Malaysia national tourism industry. Nevertheless, to maintain sustainable development of the homestay business requires some external assistance in handling tourist and finance especially at the initial stages. Hence, this research proposes an exploratory study on exploring partnerships between homestays and Luxury (luxurious) hotels. The appropriate form of partnership under Indonesian law is the Inti Plasma Partnership. Under this concept, the five-Luxury hotels are the core and homestays are the plasma. This study determines the benefits and success factors of an effective homestay program by way of an empirical study the partnership concept between MSMEs homestays and Luxury hotels in Indonesia. The study conducted with reference to Law No. 20 of 2008 concerning Partnership Law in Indonesia. Researchers conducted interviews and Focus Group Discussion (FGDs) to collect empirical data on local government and homestays in severala areas: Simalungun, Balige and Samosir Regencies, North Sumatra Province. The results found that homestay partnerships and Luxury hotels is an effective stimulus for the development and sustainability of the Homestay Industry in Indonesia Therefore, the Luxury hotel collaboration with MSMEs homestay entrepreneurs is considered as urgent and beneficial innovation for homestay tourism knowledge finding, knowledge observation and knowledge application not just in the North Sumatra tourism development but expected to the tourism industry in Indonesia.

Keywords: partnership, homestay, tourism, MSMEs

INTRODUCTION

Tourism is major income contributing sector in Indonesia. Based on data from the Central Statistics Agency (BPS), the foreign exchange earned by Indonesia from the tourism sector continued to increase before the Covid-19 pandemic. We can see this in the table below: (Statistik, n.d.)

Table of 2016-2018 State Foreign Exchange from the Tourism Sector

	Amount of Tourism Sector Foreign Exchange (Billion US$)		
Region	**2016**	**2017**	**2018**
Indonesia	11.206	13.139	16.426

Source: Central Bureau of Statistics

By 2022, the Ministry of Tourism and Creative Economy (Kemenparekraf) targets foreign tourist arrivals to reach 1.8 to 3.6 million people (Michelle Natalia, 2022).
The number of tourists is projected to generate a foreign exchange of USD 470 million to USD 1.7 billion or the equivalent of Rp. 6.7 T to Rp. 24.31 T (exchange rate of Rp. 14,300/USD). To achieve this, it must be accompanied by various efforts made by the government, business actors, and other stakeholders in the development of the tourism industry in Indonesia. One of the things that must be a concern in the development of the tourism industry in Indonesia is to develop of the "4A" concept as a tourism marketing strategy. 4A has the meaning of Attraction, Accessibility, Amenity, and Ancillary Services (Putra, 2013). Fulfillment of these 4 (four) matters can certainly provide satisfaction to tourists visiting tourist destination. As the host, of course, the area that presents the tourist attraction must be able to give a good impression so that tourists will continue to come to visit the destination.

One of the concrete steps to support this 4A strategy is to ensure accommodation services are safe, comfortable, attractive, easily accessible, able to provide friendly service and also cheap and competitive. This criterias met in various tourist destinations mostly with Luxury hotels, inns, motels and guest houses. Homestay is another form of tourist accommodation that provides a comfortable stay with a unique experience besides developing the local economy. Homestay is form of tourism program which tourists are provide with the opportunity to experience the way of life in a typical village with local community that has its own attractiveness. As a form of Community Based Tourism, the homestay concept well accepted as a form rural development tool in many ASEAN countries. The homestay program can enhance local quality of life through generation of income, support local culture, arts and crafts business, encourages restoration of local and historic sites, and foster nature conservation efforts through community education (*Asean Homestay Standard*, n.d.) The interaction provides a different experience for tourists from other cultures or western origin to experience the rich local culture besides exploring the tourist destinations. The tourist is enabled to explore and see for themselves the daily lifestyle of local residents and enjoy the local culinary. Additionally, this form of tourism also provide additional income for residents who organize homestay businesses (Kementerian Pariwisata dan Ekonomi Kreatif / Badan Pariwisata dan Ekonomi Kreatif, 2020). It provides source of income and way of doing business for local residents.

HOMESTAY CONCEPT TOURISM IN INDONESIA

The attractiveness of homestay accommodations is held in the local residential buildings encourage interaction between tourists and homestay owners who are residents in tourist destinations., to homestays. One type of accommodation service that is being developed is a

homestay. This is indicated by a large amount of assistance from the government through the Ministry of Public Works and Public Housing (*Pekerjaan Umum Perumahan Rakyat*/PUPR) in the form of assistance for the renovation/repair of residents' houses located in the National Tourism Strategic Area (*Kawasan Strategis Pariwisata Nasional*/KSPN) (Bagian Hukum dan Komunikasi Publik Direktorat Jenderal Perumahan Kementerian PUPR, 2021).

A study of the homestay development in the state of Penang, Malaysia. Namely Kampung Aur, in state of Pulau Pinang revealed that their homestay tourism industry posses tremendous potential to be developed lucratively and inclusively with the participation of the local community. However, the homestay concept since considered rather new it had required the local government assistance and guidance at the initial stage of development. Field research also showed a partnership between the Malaysian government and homestay businesses entrepreneurs was a successful collaboration and economically contributed benefited both the parties. This partnership is manifested in the form of (a) financial support for business actor groups after the formation process, (b) promotion of homestay business actor groups in tourism competitions at the Asian level, and (c) continuing education. Furthermore, the idea of homestay business since considered as small business idea like a cottage industry and requires the local community participation. It was more attractive among the Micro Small and Medium (MSMEs) entrepreneurs. The sustenance of MSME business providers furthermore also depends on the how well they can maintain, the quality of their hospitality services. .

CHALLENGES AND SUGGESTIONS FOR HOME STAY DEVELOPMENT IN INDONESIA

Therefore, educating the homestay business actors to be able to provide good and professional services to tourists is equally important a part of MSME homestay industry development in Indonesia. Therefore the homestay business actors must be given sufficient opportunity to take part in training organized by the government, in this case, the Indonesian Ministry of Tourism and Creative Economy through the Tourism Office in every Regency or city. Indonesian government adopt and benchmark on some initiatives and strategies applied by the Malaysian government in the homestay industry in Malaysia. Such as utilizing the local universities tourism experts as trainers to conduct hospitality related courses and training to improve their capacity building in the homestay tourism for interested entrepreneurs.

The types of training that can be conducted are homestay management training, makeup room training, homestay promotion, and distinguishing local community houses that meet the homestay classification (Azwar et al., 2020). Indonesia is rich with various tourist destination with variety of local community culture, food and customs. The limitations of the relevant agencies to explore this local tourism interest and other constraints such as budget constraints, human resources, in comparison to the far many number of homestays tourist destination can be improved alternatively by not just depending on the government but also by way of forming a partnership with the localized Stat Hotel through various business colloborations. For example, for Kab. Simalungun has various tourist destinations such as Parapat City, Sidamanik, Haranggaol, Tiga Ras, Bukit Indah Simarjarunjung, and so on where the total number of available homestays can reach hundreds (Lasmaria Situmorang, 2022).

The meaning of partnership differs depending on the type of business operation. In regard to homestay operation, partnership comprises those from the local government, private sector through the Corporate Social Responsibility (CSR) program, homestay management associations and Telkom University CSE program facilitators, specifically academicians who perform community service programs for homestay managers. Private sector will include

Luxury hotel business players which will be discussed thoroughly within this article. Successful partnership with these key players can develop essential resources and increase the value proposition (Sri Saraswati & Arum Inawati, 2021). The absence of private partner knowledge will almost certainly hinder the economic development process (Azwar et al., 2020).

Therefore, educational efforts to increase the capacity and quality of homestay business actors in providing services to tourists cannot be borne by the government alone, but must also involve other stakeholders such as hoteliers who certainly have qualified knowledge and skills and are able to meet the international standards in accommodation services such as Luxury hotels in tourist destination areas. According to Collin and Baum (1995), partnership from the private sector can take in a form of advisory council, as the government formulates the tourism policy, and the private sector can advise for the implementation of the policy. Luxury hotels as large-scale business actors can provide guidance to homestay business actors so that they can improve the quality of services to tourists, such as providing education related to promotions, managerial, cleaning, service, and so on. The implementation of these activities can be carried out with a partnership scheme as stipulated in Law No. 20 of 2008 concerning Partnerships ("Law No. 20/2008"). Law No.20/2008 stipulates that partnership is a form of cooperation in business relations, both directly and indirectly which is carried out based on the principles of mutual need, mutual trust, mutual strengthening, and mutual benefit between Micro and Small Business actors and Medium and Large Enterprises. The schemes offered in the partnership consist of: (i) inti-plasma; (ii) subcontract; (iii) franchise; (iv) general trading; (v) distribution and (vi) agency; and (vii) other forms of partnerships, such as profit sharing, operational cooperation, joint ventures, and outsourcing. Between Luxury hotel business actors and homestay business actors, one or several of the patterns mentioned above are related to the implementation of a partnership relationship between the two. This is to create mutually beneficial relationship between the two parties. So that homestay businesses as part of micro and small businesses can contribute to the development of the tourism industry in Indonesia. The large business partnership scheme with MSMEs can be applied to partnership relationships between Luxury hotels and homestay business actors. The concrete form of this partnership can be in the form of providing technical assistance for accommodation services, business management, providing information, guarantees, and other assistance that can encourage an increase in the quality of homestay services. This article will discuss the concept of Partnership between Large and Medium Enterprises and Small Business Actors based on Legislation in Indonesia, the urgency of the Partnership between Luxury Hotel Business Actors and Homestay Business Actors, and the Appropriate Form of Partnership.

RESEARCH METHODS

This study uses an empirical juridical method. The study is conducted based on laws and regulations related to partnerships and the tourism industry such as Law No.20/2008, Minister of Tourism and Creative Economy Regulation Number 9 of 2014 concerning Standards for Tourism Cottage Business Law Number 10 of 2009 concerning Tourism ("UU No. 10/2009"), ("Permenparekraf No.9/2014") as well as various related encyclopedias and journals. Furthermore, the researcher conducted a survey which was attended by 60 (sixty) respondents consisting of 27 men and 34 women. Further interviews with the Simalungun, Toba, and Samosir Tourism Offices, as well as 21 (twenty-one) homestay owners/managers. Data triangulation was carried out using Focus Group Discussions (FGD) involving the Regional Government and tourism business associations. The data and information obtained are analyzed with the relevant laws and regulations. So that ideas can be obtained regarding a

suitable partnership pattern between Luxury-rated hotel businesses and homestays (Christiani, 2016).

PARTNERSHIP CONCEPTS BETWEEN LARGE AND MEDIUM ENTERPRISES AND SMALL ENTERPRISES BASED ON INDONESIAN LEGAL REGULATIONS

Philosophically, partnerships in Indonesia are based on the 5th principle of Pancasila, namely Social Justice for All Indonesian People. In the economic context, the form of social justice can be interpreted that every citizen has the same opportunity to obtain life's welfare. The partnership is expected to encourage the creation of community welfare and the application of the concept of the populist economy which is internalized with community participation in various economic fields.

Ilham Junaid (2021) identified equitable partnerships as one of the important elements in achieving community capacity goals. partnership with various stakeholders and various business actors is a solid step in establishing community capacity. The carried out of community service implemented with collaborative partners for instance can take in a form of analyzing of community conditions, execution of the working system in the management of a homestay and provide guidance to carry out related community-related activities that can become destination attraction. Implementation under the order of establishment of a homestay can provide understanding to the community in identifying, determining, and creating a homestay that is appropriate to the minimum requirements (Azwar et al., 2020).

As one of the embodiments of the 5th precepts of Pancasila, the government issued Law no. 20 of 2008 as the basis for implementing partnerships between large and medium business actors and MSE business actors (Wardhana, 2016). Law No. 20/2008 comes as a substitute for Law of the Republic of Indonesia Number 9 of 1995 concerning Small Businesses ("UU No.9/1995") which is considered no longer relevant to the development of the business world today, especially regarding small businesses. and micro. Therefore, the presence of Law No.20/2008 is here to update and complement the deficiencies contained in Law No.9/1995. One of the reforms provided by Law No.20/2008 is the recognition of micro-enterprises, namely businesses that have a maximum net worth of Rp. 50,000,000.00 (fifty million rupiahs) excluding land and business buildings with a maximum annual turnover/profit of Rp. 300,000.000,- (three hundred million rupiah).

Micro business accommodation in Law No.20/2008 at least provides space and recognition for business actors whose wealth is as mentioned above. Furthermore, Law No. 20/2008 also regulates in more detail the form of partnership between large business actors and MSME actors, namely (i) inti-plasma; (ii) sub-contract partnership pattern; (iii) franchise pattern; (iv) general trading; (v) distribution and agency; and (vi) patterns of cooperation. The explanation of the various partnership patterns is as follows:

1. The inti-plasma partnership pattern, in which large business actors as the core carry out guidance and development of MSME actors. This form of guidance can be carried out by providing and preparing the land, providing production facilities, technical assistance related to production and business management; education, and provision of information needed relating to the required technology, guarantees, marketing, financing, and other assistance that can encourage increased efficiency, productivity and business insights.
2. The sub-contract partnership pattern, in which large business actors provide opportunities for MSME actors to (i) work on part of the production and/or its components; (ii) opportunity to obtain raw materials to be produced in a sustainable

manner at reasonable quantities and prices; (iii) provide production or management technical guidance and skills; (iv) provide opportunities to acquire the required knowledge and mastery of technology; (v) provide education and assistance regarding financing and payment system management that is good and profitable for the parties; (vi) prevent unilateral termination of relations;

3. The Franchise Pattern, in which large business actors provide opportunities for MSME actors to take precedence as franchise partners for large business actors as long as these business actors have the ability. Large business actors as franchisors must provide coaching and training, operational guidance in terms of managerial/management, marketing/marketing, research and development (research & development) to MSME actors as franchisees on an ongoing basis.
4. The general trading pattern, where this partnership is carried out through marketing cooperation, providing business locations, or accepting supplies from MSMEs by large businesses that are carried out openly. Fulfilling the needs of large business actors is carried out by taking supplies from MSME actors who are their partners. MSME actors must guarantee that the products supplied to large business actors meet the required standards. If MSME business actors are unable to meet the required standards, then large business actors can take the supply of goods needed from other parties.
5. Distribution and agency patterns, in which Large Enterprises and/or Medium Enterprises grant special rights (privileges) to market goods and/or services to Micro Enterprises and/or Small Enterprises
6. Patterns of joint ventures, profit sharing, and others between large business actors and MSMEs, wherein the implementation of partnerships with this scheme, if one of the parties is a foreign legal subject (foreign citizen or foreign legal entity), then both parties must pay attention to the provisions related to the negative investment list that applies in Indonesia.

The partnership patterns above can be carried out by MSE business actors with large or medium business actors. This is expected to encourage the implementation of innovation in MSE business activities which will have an impact on MSE business development. Innovation is a necessity that must be carried out by every business actor, including UMK, so that the business activities carried out can survive and have good competitiveness (Hartini, 2012).

URGENCY OF PARTNERSHIPS BETWEEN Luxury HOTEL BUSINESS PLAYERS AND HOMESTAY BUSINESS PLAYERS

This exploratory research innovation is to determine success factors for the sustainability of a MSME homestay business in the era of competition in the global era. The existence of innovation will affect the ability of business actors to develop products and provide quality services to consumers. The higher the quality of products and services provided to consumers, the higher the competitiveness of business actors with competitors (Hartini, 2012). It is important to note, the absence of innovation in business contributes to business continuity. For example, the disruption of the cellphone market with the presence of smartphones with Android technology and the iPhone operating system on the iPhone was able to remove Nokia and Blackberry from the cellphone market. The attitude of Blackberry and Nokia failure to innovate with technological developments resulted to their downfall when abandoned by consumers (Alva Rizky, 2022). Based on the examples of the Nokia and Blackberry cases above, innovation is an essential tool for businesses survival in the present business world. Similarly the Indonesia tourism industry especially in the North Sumatra must innovate their tourism style by adopting homestay tourism which has a great demand for its unique experience.

,. Homestay business actors in Indonesia generally classified as MSME actors for several reasons. This is marked by several characteristics such as business management carried out by the direct owner with simple management skill, with no Standard Operating Procedure in serving guests. Whereby the management does not maintain any proper documentation reports on the financial expenditure, , marketing, and profits. (Ngatemin, 2019).This limitation is an obstacle for homestay business actors as part of MSEs to further develop. For example, limited knowledge about preparing simple financial reports certainly makes it difficult for homestay business actors to know homestay income and expenses in a certain period. Financial reports are important so that business actors can find out the profit/loss of their business. A proper financial reports essential for planning their business strategy and to for developing its business in the future to increase their profits margin (Ngatemin, 2019). In fact, Homestay propietor are rarely exposed to the need of applying financial report.

In addition, homestays lack of marketing knowledge. Especially by way of digitally, such as using social media and preparing an attractive and informative poster and flyer content related to the homestays offered. This lack of digital skill can hinder the development of the homestay business potential to explore the tourism business in the current digital based business market . Therefore, it is important to make efforts to encourage the development of homestays partnership in digital marketing to be able to sell community products, establish excellent digital service, and establish an efficient homestay management (Junaid et al., 2021).

The implementation of partnerships between homestay business actors and Luxury hotels is expected to encourage innovation in homestay business activities. This is expected to create knowledge finding, knowledge capture, knowledge application, and knowledge sharing. (a) Knowledge Discovering is the initial process of finding knowledge (b) Knowledge Capturing, is the process of discovering new knowledge obtained from the knowledge discovery process (c) Knowledge Applying, is the process of applying knowledge that has been obtained from knowledge capturers, and (d) Knowledge Sharing, is the process of transferring knowledge (Kwanda, 2022).

The knowledge obtained from Luxury hotel business actors can contribute to good managerial system, experience, skill and knowledge for setting a standard by the government to contribute towards improving the small homestay entrepreneur's business. The partnership between homestay business actors and hoteliers can encourage innovation through expert knowledge sharing for homestay business actors in developing their business and service quality in tourism industry. Seeing the various partnership patterns offered in Law No.20/2008, the inti-plasma partnership pattern is one of the most appropriate forms of partnership to be implemented between homestay partnerships and Luxury hotels. Luxury hotels can become the core and homestays can become plasma. This is expected to encourage sharing of knowledge with homestay business actors which can encourage the development of homestay businesses from various aspects such as governance, financial management, hospitality, and so on.

FORM OF INTI PLASMA PARTNERSHIP AS THE RIGHT FORM OF PARTNERSHIP BETWEEN Luxury (LUXURIOUS) HOTEL ENTERPRISES AND HOMESTAY ENTERPRISES

Looking at the partnership pattern offered in Article 26 of Law no. 20/2008, the inti-plasma partnership pattern is the best partnership pattern to be carried out between Luxury hotel businesses and homestay actors. In the inti-plasma pattern, the Luxury-Luxury hotel business actor is the core tasked with fostering and developing homestay actors who become plasma. Forms of concrete coaching that can be carried out by Luxury hotel businesses with homestays

can be in the form of homestay marketing education, training in managing financial report records, education related to guest services, and development of information and technology-based homestay management. Related to marketing education, Luxury hotel business actors provide education to business actors regarding good and informative marketing methods. These forms of marketing can be done through social media. However, not all homestay businesspeople know what things to post on homestay social media.

Therefore, the guidance is needed regarding the substance of the content for homestay promotion. It is important to know that good marketing will influence customer decisions to buy goods/services offered by business actors (Furqon, 2017). Furthermore, related to the recording of financial reports, Luxury hotel business actors provide education related to how to prepare good and correct financial reports. Recording financial reports have various functions, one of which is to measure the results and development of business activities within a certain period (Mulyani et al., 2021). Based on the financial reports at the homestay, it can be seen the number of guests visiting during a certain period. If the number of guests staying at the homestay does not meet the target, the business actor can determine the strategy that must be followed to increase the number of guest visits to the homestay. Then, related to information and technology-based homestay development, Luxury hotel businesses can educate and facilitate homestay business actors so they can have an official website.

This will certainly make it easier for consumers, especially those from abroad, to obtain information regarding homestays and tourist destinations around the homestay. In addition, prospective guests can also make room reservations. This is of course very useful and avoids guests who do not get a place to stay while in tourist areas (Nugroho et al., 2019).Based on the description above, the role of Luxury hotel businesses is very important in encouraging the development of the homestay business through the inti-plasma partnership. Through these activities, it is hoped that Luxury hotel business actors as stakeholders who have knowledge and experience resources can educate homestay business actors so that sharing of knowledge is achieved to develop homestay businesses that can have an impact on improving the economy of homestay business actors.

The government can play a role in encouraging Luxury hotel business actors to realize the implementation of this partnership and ensure that the inti-plasma partnership as stipulated in Law No. 20/2008 can run sustainably (Pangestu et al., 2022). It is hoped that this will maintain the consistency of homestay business actors in implementing various knowledge provided by Luxury hotel business actors (Mulyani et al., 2021).Furthermore, to facilitate the coordination of the implementation of the inti-plasma partnership between Luxury hotel businesses and homestay business actors, it is important to establish an institution where homestay business actors can gather, such as a Tourism Awareness Group (Pokdarwis). This is expected to encourage convenience in organizing homestay business actors to be fostered by Luxury hotel business actors. In addition, the presence of these institutions/organizations will facilitate supervision of the implementation of this partnership by related agencies such as the Business Competition Supervisory Commission (KPPU) for oversight of partnership agreement and the Ministry of Tourism and Creative Economy (Kemenparekraf) for supporting the assistance and empowerment of the MSMEs.

CONCLUSION

The paper concluded that there are various partnership concepts regulated in Law no. 20/2008 which can be adopted and implemented by MSME business actors with large and medium business actors. Business actors can determine what form of partnership is most appropriate for the field of business being undertaken. The implementation of partnerships between

homestay business actors and Luxury hotel business actors is very crucial since development of homestay industry is economically beneficial to enhance the local community and national tourism industry. The partnership objective is also to ensure the quality and maintaine services provided by homestays to tourists as well as to sustenance or survival of the homestay. The most appropriate form of partnership proposed between homestay business actors and Luxury hotel business actors is the inti-plasma pattern. Whereby, the Luxury hotels become the core and homestays become plasma. This partnership by collaboration will serve as beneficial innovation for homestay and Luxury hotel to improve their tourism knowledge to capture and encourage and enhancing more homestay tourist business market not just in the North Sumatra tourism development but the tourism industry in Indonesia.

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AUTHORS' CONTRIBUTION

The authors from the Indonesia Purba, M.H.Y., Sirait, N. N, Rosmalinda, compiling, planning research, and perform data processing. The Malaysian research counterpart Azrul Abdullah, Suria Sulaiman and Norshamshina Mat lsa from UITM also contributed to improve with their critical feedback and helped shape the research, analysis and manuscript.

CONFLICT OF INTEREST DECLARATION

We certify that the article is the author's original work. The article has never been published before and is not in a publication elsewhere. This manuscript has never been submitted for publication and has never been published in whole or in part elsewhere. We certify that all Authors have made a significant contribution to the work, validity, and legitimacy of the data and their interpretation for submission to ICoFA 2022.

REFERENCES

Alva Rizky, H. (2022). *Disruptive Strategy and Innovation: Inovasi Cerdas Android*. 1–7.

ASEAN (2016) ASEAN Homestay Standard. Retrieved at https://www.asean.org/wp-content/uploads/2012/05/ASEAN-Homestay-Standard.pdf.

Azwar, H, Yudistira, S., & Edmizal, E. (2019). Improving Local Community Knowledge and Skills in Homestay Management. *Advance in Social Science, Education, and Humanities Research*, *464*, 6–9.

Bagian Hukum dan Komunikasi Publik Direktorat Jenderal Perumahan Kementerian PUPR. (2021). *Kementerian PUPR Bantu Pembangunan Homestay di Kawasan Wisata BTS*. 04 December.

Christiani, T. A. (2016). Normative and Empirical Research Methods: Their Usefulness and Relevance in the Study of Law as an Object. *Procedia - Social and Behavioral Sciences*, *219*, 201–207. https://doi.org/10.1016/j.sbspro.2016.05.006

Conlin, M. V., & Baum, T. (Eds.). (1995). *Island tourism: Management principles and practice*. Wiley.

Furqon, M. A. (2017). Pengaruh Experiental Marketing Terhadap Loyalitas Pelanggan Di Hotel Aryaduta Lippo Village Karawaci Effect of Experiental Marketing Towards Customer Loyalty In Aryaduta Hotel Lippo Village Karawaci Ramon Hurdawaty , Dimas Widianto Sekolah Tinggi Pariwisa. *Jurnal Inspirasi Bisnis Dan Manajemen*, *2*(2), 146–154.

Hartini, S. (2012). Peran Inovasi: Pengembangan Kualitas Produk dan Kinerja Bisnis. *Jurnal Manajemen Dan Kewirausahaan*, *14*(1), 82–88. https://doi.org/10.9744/jmk.14.1.83-90

Junaid, I. (2021). Models of Community Capacity Building for Homestay Management. *Jurnal Ilmu Sosial dan Humaniora*, *10*(2), 247-258.

Kementerian Pariwisata dan Ekonomi Kreatif / Badan Pariwisata dan Ekonomi Kreatif. (2020). Panduan Pelaksanaan KeleLuxuryian Lingkungan Pondok Wisata Panduan Pelaksanaan KeleLuxuryian Lingkungan di Homestay / Pondok Wisata. *Badan Pariwisata Dan Ekonomi Kreatif*, *2019*.

Kwanda, V. R. (2022). Pola Knowledge Management Umkm Dalam. *Economic Education And Entrepreneurship Journal*, *5*(1), 149–156.

Lasmaria Situmorang. (2022). *Interview With Simalungun Cultural and Tourism Agency*.

Majidah, M., Cahyaningsih, C., Saraswati, R. S., & Inawati, W. A. (2021). Self-Identification of Homestay Management Problems and Canvas Business Model. *Journal of Innovation and Community Engagement*, *2*(1), 1-10.

Michelle Natalia. (2022). *Devisa Pariwisata Ditargetkan Capai Rp24, 31 Triliun*. https://ekbis.sindonews.com/read/662471/34/devisa-pariwisata-ditargetkan-capai-rp2431-triliun-1642672900

Mulyani, Y., Rustika, R., Winnarko, H., & Retno Nugroho, T. (2021). Pemberdayaan Kelompok

Sadar Wisata (Pokdarwis) Tiram Tambun Dalam Pengembangan Usaha Homestay Di Desa Wisata Mentawir Kabupaten Panajam Paser Utara. *Journal of Applied Community Engagement*, *1*(1), 22–33. https://doi.org/10.52158/jace.v1i1.127

Ngatemin, N. (2019). Implementasi Akuntansi Keuangan Usaha Mikro Kecil Dan Menengah (Umkm) Pada Usaha Akomodasi Homestay Di Kabupaten Karo. *Jurnal Akademi Pariwisata Medan*, *7*(2), 47–61. https://doi.org/10.36983/japm.v7i2.50

Nugroho, A. S., Santoso, N., & Soebroto, A. A. (2019). Pengembangan Sistem Informasi Manajemen Pemesanan Homestay Desa Bajulmati berbasis Website. *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *3*(9), 9070–9075.

Pangestu, D. A., Suharso, P., & Hartanto, W. (2022). Implementasi Program Kemitraan Dan Bina Lingkungan (Pkbl) Sebagai Tanggung Jawab Sosial Perusahaan Pt. Telekomunikasi …. ... *EKONOMI: Jurnal Ilmiah ...*, *16*(2), 323–333. https://doi.org/10.19184/jpe.v16i2.25741

Putra, A. S. (2013). Pola Kemitraan Pariwisata dalam ManajemenAtraksi Desa Wisata Pampang Kota Samarinda. *Jurnal Nasional PARIWISATA*, *5*(3), 189–200.

Statistik, B. P. (n.d.). *Jumlah Devisa Sektor Pariwisata (Miliar US $), 2016-2018*. https://www.bps.go.id/indicator/16/1160/1/jumlah-devisa-sektor-pariwisata.html

Wardhana, A. W. (2016). … Hukum Kemitraan Waralaba Dengan Usaha Mikro Kecil (Umk) Berbasis Asas Efisiensi Berkeadilan Dalam Rangka Pengembangan …. *Doctrinal*, *4*. https://jurnal.um-palembang.ac.id/doktrinal/article/view/370%0Ahttps://jurnal.um-palembang.ac.id/doktrinal/article/viewFile/370/341

LAMPIRAN 2: ARTIKEL KE-2

THE PRELIMINARY STUDY ON A LEGAL FRAMEWORK ACCEPTANCE RELATE TO HALAL TOURISM IN LAKE TOBA

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Abstract

Halal tourism is one of the tourism promotion and development strategies that is expected to boost state revenues and economic growth in tourist destinations. The implementation of halal tourism aims to give confidence to Muslim tourists so they don't hesitate to travel to tourist destinations where the majority of the population is non-Muslim, such as Lake Toba. As one of the world-class tourist destinations, the concept of halal tourism is important to be implemented at Lake Toba. This is to give confidence to tourists that these tourist destinations remain friendly to Muslim tourists even though the majority of the population of Lake Toba is non-Muslim. To ensure that this can run well, the government must make regulations as the legal basis for implementing halal tourism. This study uses normative and empirical research methods. Normative research is carried out by conducting a study of laws and regulations in the field of tourism and halal products. Meanwhile, empirical research was carried out using surveys and interviews with the community and business actors in the Lake Toba area. The results obtained, halal tourism is a tourism concept that guarantees the availability of facilities and infrastructure needed by Muslim tourists during their tour such as halal food, places of worship, and so on. However, today there is a legal vacuum governing Halal tourism. So that the issue of implementing halal tourism on Lake Toba raises pros and cons. In fact, the community and business actors in the Lake Toba area accept the concept of halal tourism as long as it does not eliminate customs, and local culture and not as an effort to Islamize. Indonesia can follow the example of how Malaysia regulates the implementation of halal tourism in its country as a tourism marketing strategy.

Keywords: Preliminary Study; Legal Frameworks; Halal Tourism.

INTRODUCTION

The tourism industry is a source of state revenue that has the potential to continue to be developed (Alkadiri, et.all, 2019). One of the concrete forms of tourism development in Indonesia is to provide halal tourism in every tourist destination in Indonesia, especially national strategic tourism areas (Hermawan, 2019). Halal tourism is a tourism concept that

makes it easy for Muslims to be able to carry out their religious law while traveling (Mahardika, 2020). The concrete form of the implementation of this halal tourism is the availability of several supporting infrastructures in the form of a clean prayer room, Qibla directions, ablution places, halal restaurants, sharia hotels, and other infrastructure (Majelis Ulama Indonesia, 2016). Implementation of halal tourism is expected to give confidence and trust to tourists, especially those who are Muslim so they don't hesitate to travel to areas with a non-Muslim majority population. One of the tourism destinations that have the potential to develop halal tourism is Lake Toba. As a world-class tourism destination, tourists visiting Lake Toba come from various ethnic groups, including countries where the majority of the population is Muslim. So that to provide comfort for visiting tourists, it is only natural for business actors to provide the facilities and infrastructure needed by tourists.

For tourists who are of various Muslims, the things needed during the tour consist of the availability of halal food, facilities, and infrastructure for performing prayers such as prayer mats, Qibla directions, prayer rooms, and so on. The Indonesian Ulema Council (MUI) has issued Fatwa of the National Sharia Council-Indonesian Ulema Council No: 108/DSN-MUI/X/2016 Concerning Guidelines for Organizing Tourism Based on Sharia Principles ("MUI DSN Fatwa No.108/2016"). However, it is important to understand that the DSN MUI fatwa is not an imperative positive law to be enforced. Therefore, laws and regulations are needed as a legal basis for regulating the implementation of halal tourism in Indonesia (Rosmiati, et.all 2022).

It is important to note that the concept of halal tourism is universal in principle. This means that non-Muslim tourists can also accept the implementation of the halal tourism concept. So it is not correct if halal tourism is said to be an exclusive tourism concept that only accommodates the interests of one particular religion (Rachmiati et.all, 2020). Halal Tourism Communication Strategy Case Study of Halal Hotel Implementation in Indonesia and Thailand. In addition, it is not true that halal tourism is classified as a symbol of a certain religion which will erode local cultural values and other religions that have long existed in the destination area. Tour (Rachmiati et.all, 2020).

The existence of regulations related to halal tourism can become a legal umbrella that provides guidance to tourism stakeholders in organizing halal tourism. So that there are no more misunderstandings that have the potential to cause unrest in the community. Before making regulations, stakeholders should first explore and absorb people's aspirations. The aim is to ensure that the regulations made are accepted and implemented by the community and other stakeholders.

This article will describe the results of the research that has been carried out by digging deeper into aspirations related to the acceptance of the community and homestay business actors on Lake Toba regarding the implementation of the concept of halal tourism or Moslem-friendly tourism. It is hoped that this will provide input for stakeholders, especially the central and regional governments, in compiling regulations related to halal tourism in Indonesia, especially in the Lake Toba area. Therefore, the main focus of this article is to clearly describe the general concept of halal tourism, the factual conditions for the implementation of halal tourism in Indonesia, and the acceptance of the community and business actors in Lake Toba regarding the concept of halal tourism. It is hoped that the results of the research and thoughts outlined in this article can serve as input for the government in drafting regulations on halal tourism in Indonesia.

METHOD

This study uses normative and empirical research methods. Normative research was carried out by conducting a study of Law Number 10 of 2009 Concerning Tourism ("UU No. 10/2009"), Government Regulation Number 50 of 2011 concerning the National Tourism Development

Master Plan 2010 – 2025 (“PP No.50/2011 ”), Regulation of the Minister of Tourism and Creative Economy Number 11 of 2016 concerning Revocation of Regulation of the Minister of Tourism and Creative Economy Number 2 of 2014 concerning Guidelines for Implementing Sharia Hotel Business (“Permenparekraf No.11/2016”), Regulation of the Governor of West Nusa Tenggara Number 51 2015 concerning Halal Tourism (“NTB Governor Regulation No. 51/2015”), Regional Regulation of West Sumatra Province Number 1 of 2020 concerning Implementation of Halal Tourism (“West Sumatra Regional Regulation No. 1/2020”), and DSN-MUI Fatwa Number 08/ DSN-MUI/X/2016 concerning Guidelines for Organizing Tourism Based on Sharia Principles (“FATWA DSN-MUI No.08/2016”), related encyclopedias and journals. Empirical research was conducted by conducting a survey which was attended by 60 (sixty) respondents consisting of 27 men and 34 women. In addition, this research also conducted interviews with the Tourism Office of North Sumatra Province, Simalungun Regency, Toba Regency, and Samosir Regency, as well as 21 (twenty-one) homestay owners/managers. Data validation was carried out using a Focus Group Discussion (FGD) involving the Regional Government and tourism business associations. The data and information obtained were analyzed qualitatively so that an idea could be obtained regarding the concept of regulating halal tourism which could become a reference for legislators in drafting regulations on halal tourism (Christiani, 2016).

RESULTS AND DISCUSSION

1. Overview of Halal Tourism and Factual Conditions of Halal Tourism in Indonesia

Halal tourism is a form of tourism that is organized with a Muslim-friendly concept. The meaning of the Muslim-friendly concept is to ensure that every tourist who is Muslim is facilitated to carry out a tour that is following sharia principles. The concrete form of implementing this halal tourism concept can be in the form of: (Subarkah, 2018)

a. the availability of a clean prayer room free from uncleanness;
b. the availability of Qibla directions that make it easier for tourists to pray 5 (five) times a day;
c. the availability of clean and well-functioning ablution places;
d. the availability of halal restaurants or guides that can provide information regarding halal and non-halal food and beverages;
e. Availability of sharia hotels that prevent tourists from dealing with immorality;
f. provision of art and cultural performances as well as attractions that do not conflict with the general criteria for sharia tourism;
g. implement environmental sanitation hygiene, and so on.

Furthermore, the National Sharia Council - Indonesian Ulema Council issued DSN-MUI Fatwa Number 08/DSN-MUI/X/2016 concerning Guidelines for Organizing Tourism Based on Sharia Principles (“DSN-MUI FATWA No.08/2016”). It is important to understand that the fatwa is not a positive law that applies in Indonesia and is not binding in general. However, the substance of the Fatwa can be used as a reference for business actors who will implement halal tourism in an area. The fatwa determines a series of indicators related to halal tourism as follows:

a. Halal tourism is organized with the principle that it prevents tourists from things that smell of polytheism, immorality, tabdzir/israf, kamafsadatan, and munkar. Organizing halal tourism must be able to create benefit and benefit for various parties materially and spiritually;
b. Parties related to halal tourism consist of tourists, Sharia Travel Bureaus (BWPS), Tourism Entrepreneurs, Sharia Hotels, Tour Guides, Therapists, and other parties who are bound by several contracts.

c. Business actors in the sharia hotel sector must comply with special conditions determined by the MUI;
d. Tourists who travel to places that have implemented halal tourism must comply with the provisions regarding sharia;
e. Spa, sauna, and massage managers who apply sharia principles in carrying out their business activities;
f. The Sharia Tourism Travel Bureau must comply with the sharia provisions determined by the MUI;
g. Sharia tour guides must comply with the sharia provisions determined by the MUI;
h. The regional government or authority agency that manages these tourist destinations must ensure that several things related to facilities and infrastructure at tourist destinations are available and can be utilized properly.

Although the Fatwa has not become positive law in Indonesia, several regional regulations in Indonesia make the fatwa as one of the references in its preparation. Therefore, these indicators can be used as a guide for stakeholders organizing tourism on Lake Toba in developing halal tourism concepts that can be applied to Lake Toba.

2. Acceptance of the Lake Toba Community

As a tourist destination, the people who live around Lake Toba are the Toba Batak people. Based on the data shown in the BPS Data in Figures for 2020, the majority of the Toba Batak people in the area are Protestant Christians and Catholics with the following numbers (Badan Pusat Statistik RI, 2016):

Table 2. Total population by religion

Religion	**Amount**
Christian Protestan	270 206
Catholics	21 987
Moslem	Data Unavailable

The Toba Batak people in their daily lives cannot be separated from livestock such as pigs and buffalo. This livestock is often used in various traditional ceremonies such as marriage, death, and so on (Hutagaol & Prayitno, 2020). In addition, these animals are also used for daily consumption by the community which is processed into special culinary delights such as roast pork, saksang, lomok-lomok, and so on. Apart from food, the Toba Batak people are also familiar with palm wine, which is a type of alcoholic drink that comes from the palm sugar palm tree. These drinks are also consumed in traditional ceremonial activities or in daily life (Ikegami, 1997).

It is important to pay attention to the situation and conditions in the Lake Toba region considering that currently Indonesia has a tourism policy. First, Government Regulation of the Republic of Indonesia Number 50 of 2011 concerning the 2010-2025 National Tourism Development Master Plan. Second, Regional Regulation (Perda) No. 5 of 2018 concerning the 2017-2025 North Sumatra Provincial Tourism Development Master Plan. These two regulations are the foundation for tourism development to ensure an increase in people's welfare, especially in tourist destination areas such as Lake Toba.

It is important to know that the situations and conditions related to the daily life of local people contradict the daily life of some tourists, especially tourists who are Muslim. This is because food and drinks that are commonly consumed by local residents cannot be consumed because Islamic teachings prohibit adherents from consuming these foods and drinks (Yanggo, 2013). Therefore, stakeholders related to organizing tourism on Lake Toba must accommodate the needs of Muslim tourists like the availability of halal food and drinks. One concrete form to accommodate this need is to implement the concept of halal tourism on Lake Toba.

Implementation of this concept can be realized by providing food and beverage facilities that are guaranteed to be halal, availability of places of worship, and so on. Based on the results of interviews with the community and homestay business actors in the Lake Toba area, most of the community and business actors reject the implementation of halal tourism in the Lake Toba area. This is due to concerns that halal tourism is part of Islamization which will replace the customs/mores of the Batak people and shift the existence of Christianity. This was exacerbated after the North Sumatra Governor's statement that he would implement halal tourism in the Lake Toba area. This has caused unrest in the Lake Toba community. This is because there are concerns that the implementation of halal tourism will prohibit the existence of pigs and swine livestock. Even though these animals are very closely related to the customs of the Batak people and are used in various ceremonies, marriages, deaths, and so on.

If it is reviewed with the concept of halal tourism as previously mentioned, this is of course unfounded and is a mistake in understanding the concept of halal tourism. This is because halal tourism is not part of Islamization or a symbol of Islam, but rather a tourism marketing strategy for tourists so that tourists do not hesitate when visiting tourist destinations where the majority of the population are non-Muslims. This is realized by providing the facilities and infrastructure needed by tourists who are Muslim. In addition, it is not true that the concept of halal tourism if implemented in the Lake Toba Region will result in local culture, especially Batak culture, being eroded by other cultures. This is also guaranteed in the provisions of Law No. 10/2009 and the principles of tourism which stipulate that the implementation of tourism must respect the original culture of the community and local wisdom.

The emergence of misunderstandings and unrest in the community regarding the concept of halal tourism is due to the lack of socialization and the absence of clear rules regarding halal tourism in Indonesia. This is by interviews that have been conducted with homestay business actors who firmly state that there has never been any socialization carried out by government agencies, especially the Tourism Office, both at the Provincial and Regency/City levels regarding halal tourism. This resulted in the understanding of the community and business actors in the Lake Toba area being limited and tending to be anticipatory regarding this concept. Even after being given an explanation to business actors regarding the concept of halal tourism, in the end, the majority of them accepted and agreed with the concept of halal tourism. However, several things must be considered in implementing this concept, including:

a. Halal tourism is not an Islamization;
b. the term halal tourism is changed to Muslim-friendly tourism;
c. do not label Lake Toba as halal tourism;
d. the government provides real support to business actors in providing the infrastructure needed in implementing the halal tourism concept;
e. there are clear regulations related to halal tourism.

Therefore, a soft approach and good communication need to be carried out so that businesses and the people of Lake Toba have a good understanding of halal tourism. The government must be able to make this happen. The government can cooperate with universities in providing a thorough understanding related to halal tourism through the Higher Education Tri Dharma program and other programs that can synergize various parties.

3. Comparison of Halal Tourism Arrangements with Malaysia

This paper chooses Malaysia as a comparison. Apart from having geographic similarities, they are both located in the Southeast Asia region, Malaysia's position which ranks 1st as a destination country for halal tourism is the strongest reason to lessons can be taken from Indonesia's neighboring countries. The halal industry in Malaysia is developing well because it is supported by the development of halal standards and a systematic halal assurance system that is applied nationally (Mastercard, 2022) .

It should be noted that Malaysia has been a pioneer in the development of halal standards, which until now has issued around 10 Malaysian Standards (MS), which are used as guidelines, both nationally and globally. 2 (two) of the 10 MS, namely MS 1500:2009 (Halal Food – Production, Preparation, Handling, and Storage – General Guidelines) and MS 2424 (General Guidelines for Halal Pharmacy 2012) have even become the world's first halal guidelines for medicines. [Islamic Tourism Standards – Islamic Tourism Center of Malaysia | ITC] Apart from that, Malaysia's other achievements in the halal industry are the recognition of the certification, production, and distribution of halal food from Malaysia to many non-Muslim countries (Ngui, 2014). As well as complying with Halal requirements, food manufacturers in Malaysia are encouraged to adopt and maintain standards that meet global benchmarks such as ISO 9000, Codex Alimentarius, Quality Assurance Program, Hazard Analysis and Critical Control Points (HACCP), Good Hygiene Practices (GHP), and Sanitation Standard Operating Procedures (SOP). Malaysia's excellence in the halal industry cannot be separated from the role of the Malaysian Standards Department, which is under the Ministry of Science, Technology, and Innovation (MOSTI), in collaboration with SIRIM and JAKIM as a law enforcement authority (Ab Latiff et.all, 2022).

The global halal food trade in Malaysia is estimated at over USD 600 billion every year. Halal certification issued by JAKIM can be used as a marketing tool by food stores and food product manufacturers. The relationship between halal food products and food safety and hygiene has a universal impact and is approved not only by Muslims but also non-Muslims. Standards and certifications ensure that manufacturers act responsibly to maintain the halal status of their products during all stages of production, from the raw materials and ingredients used to the processing and distribution of products.

Turning to the halal tourism sector, Malaysia has standards and guidelines like those they apply to halal food products. The preparation and application of standards such as those carried out by Malaysia have an important role because the government builds Malaysia's credibility in the global halal trade and tourism industry. The existence and adherence to standards and guidelines in a country are important and non-negotiable if it is to attract Muslim visitors because it increases visitor confidence in the country's products and services, thus increasing the country's attractiveness and value as a tourist destination in the eyes of Muslim visitors.

The writing team has conducted benchmarking related to halal tourism in the city of Penang, Malaysia, where homestay owners pay attention to Muslim-friendly standards set out in terms and conditions that must be obeyed by every homestay visitor. For example, it is not permissible to bring pets such as dogs and there is a separation of cutlery for Muslim and non-Muslim visitors. Furthermore, there is a special homestay area in Aur City which consists of community houses that are rented out to tourists, both local and foreign. The homestay area applies halal standards and this is evidenced by the existence of a plaque from the Malaysian government service which guarantees cleanliness, service, and hospitality. Homestay owners are given training and outreach about attracting tourists, and the Government of Malaysia is also providing incentive funds for homestay repairs to homestay owners. The Malaysian Government's support for halal tourism has been regulated with good regulations and is also manifested in providing support as concrete evidence.

Seeing Malaysia's success in implementing the concept of Moslem Friendly Tourism is expected to be a stimulus for Indonesia as a country with a majority Muslim population to help improve the implementation of halal tourism. One of the concrete manifestations of this is carried out by compiling regulations as a legal basis and continuous socialization regarding Moslem Friendly Tourism. The existence of regulations governing halal tourism or Moslem Friendly Tourism in Indonesia will be the basis for encouraging stakeholders in the tourism sector to play an active role in adjusting their hotels or homestays to be comfortably occupied by Muslim tourists. Several regions in Indonesia, such as West Sumatra and West Nusa

Tenggara, already have regional regulations governing halal tourism. However, for regions in Indonesia where the majority of the population is non-Muslim, such as North Sumatra, the legal vacuum of regulations related to halal tourism is a stumbling block in making a profit from tourism activities.

The absence of regulations that have an impact on misunderstandings in interpreting the concept of halal tourism in Indonesia can cause friction between society and business actors. If this is allowed to continue, it will result in tourists, especially those who are Muslim, being reluctant to return to tourist destinations with a non-Muslim majority population such as Lake Toba. Therefore, to prevent this from happening, the government must pay attention to drafting regulations related to halal tourism in Indonesia.

CONCLUSION

Halal tourism is a tourism concept that guarantees the availability of facilities and infrastructure needed by Muslim tourists during their tours such as halal food, places of worship, and so on. However, today there is a legal vacuum governing halal tourism. So that the issue of implementing halal tourism on Lake Toba raises pros and cons. In fact, the community and business actors in the Lake Toba area accept the concept of halal tourism as long as it does not eliminate customs, and local culture and not as an effort to Islamize. Indonesia can follow the example of how Malaysia regulates the implementation of halal tourism in its country as a tourism marketing strategy.

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AUTHORS' CONTRIBUTION

The authors from the Indonesia Purba, M.H.Y., Sirait, N. N, Yuswar, C.P. compiling, planning research, and perform data processing. The Malaysian research counterpart [******], [******] and [******] from UITM also contributed to improve with their critical feedback and helped shape the research, analysis and manuscript.

REFERENCE

Ab Latiff, J., Abbas, S., & Armia, M. S. (2022, August). A Study on Halal Certification Procedure: Progressive Transition Towards Halal Pharmaceutical Products in Malaysia and Indonesia. In *Selected Proceedings from the 1st International Conference on Contemporary Islamic Studies (ICIS 2021)* (pp. 3-12). Singapore: Springer Nature Singapore.

Akadiri, S. S., Akadiri, A. C., & Alola, U. V. (2019). Is there growth impact of tourism? Evidence from selected small island states. *Current Issues in Tourism*, *22*(12), 1480-1498.

Christiani, T. A. (2016). Normative and empirical research methods: Their usefulness and relevance in the study of law as an object. *Procedia-Social and Behavioral Sciences*, *219*, 201-207.

Fatwa DSN-MUI Nomor 08/DSN- MUI/X/2016 tentang Pedoman Penyelenggaraan Pariwisata Berdasarkan Prinsip Syariah

Hermawan, E. (2019). Strategi Kementerian Pariwisata Indonesia Dalam Meningkatkan Branding Wisata Halal. *Jurnal Ilmu Manajemen dan Akutansi*, *7*(2), 87-95.

Hilda, L., & Si, M. (2014). Analisis Kandungan Lemak Babi dalam produk pangan di Padangsidimpuan secara kualitatif dengan menggunakan Gas Kromatografi (GC). *Tazkir*, *9*, 1-15.

Hutagaol, F. O., & Prayitno, I. S. P. (2020). Perkembangan Ritual Adat Mangongkal Holi Batak Toba dalam Kekristenan di Tanah Batak. *Anthropos: Jurnal Antropologi Sosial dan Budaya (Journal of Social and Cultural Anthropology)*, *6*(1), 84-92.

Ikegami, S. (1997). Tuak dalam Masyarakat Batak Toba. Laporan Singkat tentang Aspek Sosial-Budaya Penggunaan Nira. *Annual Report of the University of Shizuoka. Hamamatsu College*, (11-3).

Mahardika, R. (2020). Strategi Pemasaran Wisata Halal. *Mutawasith: Jurnal Hukum Islam*, *3*(1), 65-86.

Mastercard, B. (2016). MasterCard-Crescent Rating Global Muslim Travel Index 2016 Global Muslim Travel Index 2016.

Rachmiatie, A., Fitria, R., Suryadi, K., & Ceha, R. (2020). Strategi Komunikasi Pariwisata Halal Studi Kasus Implementasi Halal Hotel di Indonesia dan Thailand. *Amwaluna: Jurnal Ekonomi dan Keuangan Syariah*, *4*(1), 56-74.

Rosmiati, R., Soumena, M. Y., & Said, Z. (2022). Strategi Dinas Kepemudaan Olahraga Dan Pariwisata Dalam Pengembangan Pariwisata Syariah Kota Parepare. *Shi'ar: Sharia Tourism Research*, *1*(01), 43-60.

Subarkah, A. R. (2018). Potensi dan prospek wisata halal dalam meningkatkan ekonomi daerah (studi kasus: Nusa Tenggara Barat). *Sospol: Jurnal Sosial Politik*, *4*(2), 49-72.

Yanggo, H. T. (2013). Makanan dan Minuman dalam perspektif hukum islam. *Tahkim IX (2)*, *2*.

https://tobasamosirkab.bps.go.id/statictable/2017/09/28/ 261/number-of-religious people-by-district-year-2016.html accessed on 22 April 2022

https://www.Hukumonline.com/klinik/a/kedudukan-fatwa-mui-dalam-Hukum-indonesia-lt5837dfc66ac2d, downloaded on 27 April 2022

LAMPIRAN 3-DRAFT TULISAN 3

The Comparative Study of Muslim Friendly Homestay Programs in Indonesia and Malaysia:
A Social Legal Perspective

ABSTRACT

This paper aims to compare the application of the concept of halal tourism in Indonesia and Malaysia, especially in the case of Moeslem Friendly Homestays. The research method used is normative juridical research with a comparative approach. The research was carried out by taking an inventory of the laws and regulations regarding halal tourism that have been owned by several regions in Indonesia. Then compared with the implementation of halal tourism, especially in organizing Moeslem Friendly Homestay on Lake Toba, North Sumatra with Malaysia. The results of the research show that Indonesia does not yet have a legal umbrella governing halal tourism, only a few cities and provinces have regional regulations. Some regions that already have regulations are West Nusa Tenggara Governor Regulation Number 51 of 2015 concerning Halal Tourism, West Sumatra Province Regional Regulation Number 1 of 2020 concerning Implementation of Halal Tourism, North Sumatra Governor Regulation No. 19 of 2022 concerning Regulations for Implementing Halal Tourism Regional Regulations, Bandung Regency Regional Regulation Number 6 of 2020 concerning Halal Tourism, and South Sulawesi Regional Regulation Number 9 of 2019 concerning Halal Tourism. These data show that the State of Indonesia does not have a legal umbrella for organizing halal tourism. In contrast to Malaysia, the success of Malaysia's

halal tourism industry is largely due to the development of halal standards and a systematic halal assurance system implemented nationwide. Malaysia's Islamic Development Department initiated a policy of standardizing halal food and standards such as Muslim Friendly Hospitality Services (MFHS) which contain three important components: the principle of providing accommodation, tour packages, and guide tours based on Islamic principles..
Keywords: Comparative Study, Muslim Friendly Homestay, Legal Framework

1. PENDAHULUAN

Indonesia is a country that has the largest Muslim population in the world, reaching 87.18% of a population of 232.5 million, which is around 202.6 million.[37] This figure shows that Indonesia has a large market share for halal products and services. One of the service sectors that is crucial for the country's economic development is tourism. When associated with the demographics of Indonesia's population, which is predominantly Muslim, halal tourism has great potential as an opportunity for Indonesia to diversify its economy. This can also be a source of foreign exchange in Indonesia, increase MSMEs, and create jobs so as to increase the level of people's welfare.

Based on data from the Muslim Travel Index, in 2021 it is estimated that there will be 140 million Muslim tourists globally, this number is expected to continue to grow to 230 million in 2026.[38] This halal tourism potential must be utilized by the Government of Indonesia. The tourism sector is developing rapidly and is the largest economic sector with a contribution to foreign exchange of USD 13,568 billion, ranking second after the palm oil industry which reached USD 15,965 billion in 2016.[39]

Gambar 1. Dampak Pariwisata terhadap Ekonomi Global[40]

[37] Masterplan Ekonomi Syariah Indonesia, 2019 – 2024, Kementrian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional

[38] Indonesia Muslim Travel Index 2021 Report

[39] Chandra, A. A., & Damarjati, D. (2017, Oktober 17). Tiga Tahun Jokowi-JK, Pariwisata Sumbang Devisa Terbesar Kedua. Retrieved from Detik.Com: https://finance.detik.com/berita-ekonomi-bisnis/d-3687715/tiga-tahunjokowi-jk-pariwisata-sumbang-devisa-terbesar-kedua

[40] Laporan Travel & Tourism Economic Impact World (WTTC 2018)

In the context of being a halal tourist destination, Indonesia has several comparative advantages, namely: the world's largest Muslim population, unique and beautiful natural attractions and communities, and cultural heritage. This competitive advantage can be utilized by Indonesia to become a halal tourist destination globally.[41] However, this comparative advantage is not in line with the development of halal tourism in Indonesia. According to the State of the Global Islamic Economy Report 2022, in the Muslim Friendly Travel sector, Indonesia is not even among the top 10 halal tourist destinations.[42]

Based on data from the State of the Global Islamic Economy Report 2022, it is estimated that total Muslim spending will reach USD 2 trillion in 2021, which is around 0.27% of the world's total gross product. Consumption of halal food, pharmaceuticals, cosmetics, tourism, and the media sector for recreation. Fashion, media and recreation, travel, pharmaceuticals, and cosmetics are the largest contributors. This spending increased by around 8.9% from 2020.[43] This figure has the potential to increase along with the growth of world population.

Indonesia has the potential to create and improve Moeslem Friendly Tourism destinations. The main goal is to increase the attractiveness and convenience of Muslim tourists coming to Indonesia. Therefore, improving amenity services, attractions, and the accessibility of Muslim tourists must continue to be developed. This has enormous potential for Indonesia's foreign exchange earnings in the tourism sector. However, due to the absence of a legal umbrella that regulates halal tourism, the implementation is ineffective. In several regions in Indonesia, there are regional regulations that regulate halal tourism, but they do not specifically address the standards that must be met as a condition for halal tourism and specifically regulate Moeslem Friendly Homestay.

The current legal basis for halal tourism is Law Number 10 of 2009 concerning Tourism, as well as Law Number 33 of 2014 concerning Guarantees for Halal Products. However, these two laws can only be used as a complementary legal basis for halal tourism, because there are no articles related to halal tourism. Halal tourism arrangements are comprehensively regulated in the DSN-MUI Fatwa Number 08/DSNMUI/X/2016 concerning Guidelines for Organizing Tourism Based on Sharia Principles, however DSN fatwa does not have binding legal force. So, the research problem lies in how the formation of halal tourism law is seen from philosophical, juridical and sociological aspects.

In Malaysia, the development of a nationally implemented systematic halal standard and halal assurance system. The Malaysian Islamic Development Department started a policy of standardizing halal food as well as standards such as Muslim Friendly Hospitality Services (MFHS) which contain three important components, namely the principle of providing accommodation, tour packages and guide tours based on Islamic principles.[44]

2. PROBLEMS

A. How does the regulation of Halal Tourism in Indonesia compare to Moeslem Friendly Tourism in Malaysia?
B. How effective is the current implementation of halal tourism regulations in Indonesia in the implementation of standard Muslim Friendly Homestays?

[41] Indonesia Muslim Travel Index 2019 Report
[42] *State of The Global Islamic Economy Report* 2022, hlm. 5
[43] *Ibid.*
[44] Hukum Pariwisata di ASEAN, Dr. Muhammad Reza Syarifuddin Zaki, Abdul Rasyid, Jakarta: Kencana, 2021, hlm. 75

2. METODE PENELITIAN

The method used in this research is juridical, which clearly describes the Indonesian legal system in the regulation of halal tourism in Indonesia. The data that has been collected and processed will be discussed using the Qualitative Normative method, namely the discussion is carried out by interpreting and discussing the data that has been obtained and processed, based on legal norms, legal doctrines and existing legal science theories, related to data collection researchers conducted surveys with homestay owners, interviews with local government, and Focus Group Discussions with related government agencies. Source of data used in the form of primary data and secondary data. The data that has been collected is then processed and discussed using qualitative methods and then presented descriptively.

3. HASIL DAN PEMBAHASAN

POTENSI WISATA HALAL DI INDONESIA

Along with increasing public awareness of the importance of halal and haram products, halal tourism is also currently a necessity, especially for Muslims. The Islamic economic movement in Indonesia is not only in the Islamic financial sector, but also in the real sector. There are sharia cafes, around 730 hotels with Muslim friendly or sharia concepts with an average growth of 10% every year. Islamic economics also exists in a broader economic field, namely with the presence of 2 Islamic Traditional Markets located in Surabaya, East Java and West Lombok in West Nusa Tenggara. The concept of halal according to sharia also touches on halal tourism, such as 2 Syariah Beaches located in Lombok, West Nusa Tenggara and Banyuwangi in East Java, a halal cultural destination in Aceh, a halal culinary destination in West Sumatra, and others.[45]

One of the priority programs of the Ministry of Tourism and Creative Economy (Kemenparekraf) is the development of Indonesian halal tourism. The government has a vision to make Indonesia a world-class halal tourist destination. Expert Staff of the Minister of Tourism for Economic Affairs and Creative Areas, Kemenparekraf Anang Sutono, in Focus Group Discussion IV of the 2020-2024 Implementation Plan for Indonesia's Islamic Economic Development which is being held by the National Islamic Finance Committee (KNKS), at the Ritz-Carlton, Jakarta, Friday (22/11) said there are nine Kemenparekraf strategies: First, provide facilities and services that make it easier for tourists. Second, increase the attractiveness or attraction of Muslims. Third, developing the connectivity of halal tourist destinations. Fourth, conducting marketing based on destination, origin and time, as well as preferences from the Muslim travel market. Fifth, developing promotion and marketing communications for sales of halal tourism. Sixth, encourage the use of digital media for marketing. Seventh, develop the quality and quantity of human resources. Eighth, strengthening policies and institutions, synergizing stakeholders, and conducting research. Ninth, increasing industry competence through the development of Muslim-friendly tourist destinations.[46]

Data from the 2022 Global Muslim Travel Index (GMTI) report, Indonesia ranks 2nd as a halal tourist destination in the world. Seven factors have contributed to the increasing growth of the global halal tourism sector, namely growth in the Muslim population, growth in Muslim middle class income / disposable income, millennial Muslim population, increased access to travel information, increased travel service providers that accommodate Muslim (Muslim) worship needs. friendly), Ramadhan

[45]

[46] Komite Nasional Ekonomi dan Keuangan Syariah (knks.go.id), diakses pada tanggal 20 Februar1 2021

travel, and travel business. These factors motivate countries in the world to slowly start to focus on developing halal tourism. This development according to GMTI (2018) needs to be focused on four main things, namely ease of access, communication, environment, and services.[47]

The halal tourism industry cannot be separated from its supporting industries or in this case it is included as a series of entry points. These several entry points form a halal tourism value chain consisting of tourism destinations, means of transportation, hotels and accommodations, restaurants and cafes, as well as travel and tours.[48]

Based on GMTI data, Saudi Arabian tourists spent US$21 billion, US$16 billion spent by tourists from the United Arab Emirates, and from Qatar spent around 13 billion US$ on tourism. From this it is clear that it is a necessity if Indonesia wants to attract foreign tourists from the Middle East region which incidentally are countries with Muslim populations. These countries are the countries with the largest tourism travel expenses.[49]

HALAL TOURISM REGULATIONS IN INDONESIA

Indonesia is collaborating with several parties to develop halal tourism, including the Ministry of Tourism and Creative Economy in collaboration with the National Sharia Council (DSN), the Indonesian Ulema Council (MUI), and the Business Certification Institute (LSU). fatwa of the National Sharia Council of the Indonesian Ulema Council (DSN-MUI) Number 108/DSN-MUI/X/2016 concerning guidelines for organizing tourism based on sharia principles states that halal tourism is tourism that complies with sharia principles. In this case, what is meant by sharia principles is in accordance with the DSN-MUI fatwa. So, the entire halal tourism industry related to its implementation must comply with the DSN-MUI fatwa, such as sharia hotels, halal restaurants, halal travel agencies, spas and so on.[50]

The Ministry of Tourism and Creative Economy (Kemenparekraf) in collaboration with the Indonesian Ulema Council held a Grand Launching of Sharia Tourism. The purpose of holding this program is to attract both domestic and foreign tourists and to encourage the development of sharia business entities in the sharia tourism environment in Indonesia. The development of sharia tourism will be focused on four types of businesses, namely in hotels, restaurants, travel agencies or services, and spas. The Ministry of Tourism-Creative Economy and the National Sharia Council of the Indonesian Ulama Council set standard tourism criteria as follows:[51]

a. Aims for social welfare.

b. Aims at refreshment, education, and peace.

c. Keep away from khurofat and polytheism.

d. Keep away from bad deeds, such as adultery, pornography, pornography, alcohol, drugs and gambling.

e. Pay attention to behavior, ethics and noble human values, such as not being indifferent and immoral.

f. Pay attention to security, reliability, and peace.

g. It has an inclusive and universal character.

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[47] Masterplan Ekonomi Syariah Indonesia, 2019 – 2024, Kementrian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional, hlm. 71

[48] Ibid., hlm. 76

[49] Mastercard-Cresentrating Global Muslim Travel Index 2022, Page 29

[50]

[51] Sofyan, R. (2012). *Prospek Bisnis Pariwisata Syariah* (I). Republika.

h. Pay attention to environmental conservation.
i. Promote socio-cultural values and local wisdom.

However, this collaboration did not result in a comprehensive regulation governing halal tourism. Regulation of the Minister of Tourism and Creative Economy Number 2 of 2014 concerning Guidelines for Implementing Sharia Hotel Business ("Permenparekraf 2/2014") has been revoked by Regulation of the Minister of Tourism and Creative Economy Number 11 of 2016 concerning Revocation of Regulation of the Minister of Tourism and Creative Economy Number 2 of 2014 regarding Guidelines for Implementing Sharia Hotel Business because Permenparekraf 2/2014 is no longer in line with current tourism demands and developments. In fact, Permenparekraf 2/2014 is a mandate from Article 14 paragraph (2) of Law Number 10 of 2009 concerning Tourism ("Tourism Law") before being amended by Law Number 11 of 2020 concerning Job Creation ("Job Creation Law") . However, the Permenparekraf was later repealed so that there were no more regulations specifically governing the sharia hotel business.[52]

MUI fatwa is a decision issued by MUI regarding a problem in the life of Muslims. Referring to the types and hierarchies of laws and regulations in Indonesia in Law Number 12 of 2011 concerning Formation of Legislation, the position of the DSN-MUI Fatwa is not a type of statutory regulation that has binding legal force. MUI fatwa is only binding and obeyed by Muslims. MUI fatwas do not have the force of law to compel them to be obeyed by all Indonesian people. This MUI Fatwa should be written down in the form of Legislation so that it can apply effectively. Therefore, with the repeal of Permenparekraf 2 of 2014, there is a legal vacuum, especially regarding the regulation of sharia hotel businesses. To carry out the mandate of the Tourism Law, the government should immediately issue new regulations regarding sharia hotel businesses which are of course adapted to the current demands and developments in tourism. Especially in Indonesia, halal tourism is growing rapidly.

At present, regulations regarding halal tourism are only regulated through regulations in several regions, namely West Nusa Tenggara Governor Regulation Number 51 of 2015 concerning Halal Tourism, West Sumatra Provincial Regulation Number 1 of 2020 concerning Implementation of Halal Tourism, North Sumatra Governor Regulation No. 19 of 2022 concerning Regulations for Implementing Halal Tourism Regional Regulations, Bandung Regency Regional Regulation Number 6 of 2020 concerning Halal Tourism, and South Sulawesi Regional Regulation Number 9 of 2019 concerning Halal Tourism.

Lombok is ranked first as a leading destination for halal tourism in Indonesia as a result of the high commitment of the Regional Government (Pemda) of West Nusa Tenggara Province (NTB) in developing halal tourism in the province. Since 2016, the NTB Provincial Government has collaborated with MUI and LPPOM, the Culture and Tourism Office, and MSMEs have consistently carried out halal certification for hotel restaurants, non-hotel restaurants, restaurants and MSMEs. There are 644 halal certificates that have been issued. In addition to halal food, the availability of worship facilities is also very easy to find in NTB. As an area with a Muslim population reaching

[52] Urgensi Standardisasi Pariwisata Halal Dalam Pengembangan Pariwisata Di Indonesia Perspektif *Maqâshid Asy-Syarî'Ah*, Skripsi Nur Ruwaida, Fakultas Syariah dan Ekonomi Islam, Institut Ilmu Al-Qur'an (IIQ), 2020, hlm.

90%, there are 4,500 mosques spread across 598 villages and sub-districts. So that NTB is also dubbed as the island of a thousand mosques.[53]

The city of Bandung in 2018 received an award as the best halal tourism destination from the Ministry of Tourism of the Republic of Indonesia at the Wonderful Indonesia Halal Tourism Meeting and Conference event. The Bandung city government also signed an MoU with the Ministry of Tourism regarding increasing the development of halal tourism in the city of Bandung with the aim that the city of Bandung is always committed to providing a number of facilities for halal tourism. Bandung also supports the development of halal tourism in the City of Bandung. The Bandung Tourism College (STP) is one of those that play a role in the field of education for tourism under the supervision of the Indonesian Ministry of Tourism. STP Bandung already has a study center for the study of halal tourism and products called Enhaii Halal Tourism Center (EHTC) which takes part in studying the potential for the development of halal tourism in the city of Bandung. The Bandung City Government formed the Bandung City Halal Tourism Acceleration Team to increase halal tourism in the City of Bandung. The government through the Halal Product Assurance Organizing Agency (BPJPH) and LPPOM-MUI have the authority and duty to provide halal certification for a tourism product or service. MUI Bandung City provides full support in the development of halal tourism in the City of Bandung by conducting tests on halal food in the laboratory and providing halal certification for industry players. The support of the Bandung City Government for MSME actors is shown by access to obtaining halal certification at the Bandung City Trade and Industry Service for free because it is funded by the government. Halal industry players will get service facilities in the form of assistance with halal label permits, food nutrition inspections, packaging consultations to brand rights.[54]

With the ranking received by Indonesia from the 2022 Global Muslim Travel Index (GMTI), Indonesia is ranked 2nd as a halal tourist destination in the world. This shows that Indonesia is a superior destination in terms of halal tourism. This should be balanced with adequate and definite regulations to serve as guidelines for the implementation of halal tourism in Indonesia. Indonesia has the potential to become a center for halal tourism on a global scale because it is supported by natural beauty, cultural diversity and the largest Muslim population in the world. The role of KEMENPAR in promoting Indonesia as a center for halal tourism destinations also deserves appreciation. However, the development of halal tourism is not only carried out by carrying out massive promotions to get a certain position on a global scale, but also must be supported by strong regulations as a legal basis. From a regulatory standpoint, halal tourism in Indonesia is classified as weak because there are no specific regulations governing it either in the form of laws or ministerial regulations. The development of halal tourism is a must if Indonesia wants to attract foreign tourists from the Middle East region which are Muslim countries. These countries are the countries with the largest tourism travel expenses.

DILEMA PENERAPAN KONSEP WISATA HALAL DI INDONESIA

[53] Strategi Pengembangan Pariwisata Halal Di Indonesia *Halal Tourism Development Strategy In Indonesia Nidya Waras Sayekti* (Pusat Penelitian, Bidang Ekonomi Dan Kebijakan Publik, Bkd

[54] Paradiplomasi Bandung Menuju Kota Wisata Halal, Windy Dermawan, Akim, Henike Primawanti Indonesian Perspective, Vol. 5, No. 2 (Juli-Desember 2020): 183-200

The Organization of the Islamic Conference (OIC) provides a definition of Islamic Tourism as a tourist trip to provide tourist services and facilities for Muslim tourists in accordance with Islamic principles. Several terms are used besides Islamic Tourism, namely Halal Tourism, Sharia Tourism, Muslim Friendly Tourism. However, the understanding of halal tourism in Indonesian society is still biased. Indonesian people tend to view halal tourism as religious tourism. Halal tourism is the adoption of non-OIC countries which create halal tourism to accommodate the needs of Muslims in non-OIC countries, such as providing places of worship and halal restaurants.[55]

Halal tourism is often equated with religious tourism, but halal tourism has a broader meaning than religious tourism, which includes all tourism based on Islamic sharia values, not only for Muslim tourists, but also for non-Muslim tourists.

Public awareness of the terminology of halal tourism is still relatively low. There are three groups belonging to religious tourism as derivatives of historical tourism, and at first glance they seem overlapping. However, from the point of view of tourist motivation (push factors) and destination attractiveness (full factors) the three groups have differences. Pilgrimage tourism is tourism with spiritual motivation aimed at getting closer to the Creator and seeking tranquility in accordance with the principles of tourist beliefs, such as Hajj or Pilgrimage.[56]

Misunderstanding of halal tourism can be one of the obstacles in the development of halal tourism in Indonesia. Therefore, there is a need for a common understanding between the government, stakeholders and the public regarding halal tourism. The role of the National Sharia Council of the Indonesian Ulama Council (DSN MUI) is needed as a fatwa-producing institution (a decision on an issue related to Islamic law) is needed in providing guidelines so that a common understanding is formed regarding halal tourism in Indonesia. Through a social-community and social engineering approach with several core messages as follows: First, make halal tourism a determining factor for tourist destinations that provide special added value, such as guaranteeing safety and comfort during tourist trips. Second, halal tourism has a broader meaning as a friendly tourist place/destination for Muslim tourists (moslem friendly tourism). This can be done by completing various halal infrastructure facilities that support the basic needs and additional needs of Muslim visitors/tourists while going to, being and returning from a tourist destination.[57]

In order to develop and improve halal tourism in Indonesia, it is necessary to develop a new paradigm regarding the concept of halal tourism in Indonesia. This is so that the concept of halal tourism can be accepted by non-Muslim Indonesians. Because even though in Indonesia the majority of the people are Muslim, there are also some areas where the people are more non-Muslim, for example in Samosir, North Sumatra. Even though the tourist destination of Lake Toba is one of the 10 National Tourism Destinations (DPN) in accordance with Government Regulation Number 5 of 2011 concerning the National Tourism Development Master Plan for 2010 – 2025 and which has become five super priority destinations by the Indonesian government in its joint development with Borobudur, Mandalika, Labuan Bajo, and Manado.

REGULASI MUSLIM FRIENDLY TOURISM DI MALAYSIA

As a comparison with Malaysia, which ranks 1st as a destination country for halal tourism.[58] The country of Malaysia has a well-developed halal industry and an

[55] *Halal Tourism Development Strategy In Indonesia, Nidya Waras Sayekti,* Pusat Penelitian, Bidang Ekonomi Dan Kebijakan Publik, Bkd, 2019

[56] Ibid

[57] Ibid

[58] MASTERCARD-CRESCENTRATING GLOBAL MUSLIM TRAVEL INDEX 2022, page 34

extensive network of halal restaurants across the country – its two biggest strengths when it comes to halal tourism. The success of the Malaysian halal industry is largely due to the development of halal standards and a systematic system of halal assurance implemented nationwide.

Malaysia is a pioneer in developing halal standards and to date has issued around 10 Malaysian Standards (MS) which are used as guidelines both nationally and globally. These standards include MS 1500:2009 (Halal Foods – Production, Preparation, Handling and Storage – General Guidelines) and MS 2424 (Halal Pharmaceutical General Guidelines 2012), which are the world's first Halal guidelines for pharmaceuticals.[59]

The development of Malaysian standards for the Halal industry was spearheaded by the Malaysian Standards Department under the Ministry of Science, Technology and Innovation (MOSTI), in collaboration with SIRIM and JAKIM (Department of Islamic Development Malaysia) which is under The Prime Minister Department. JAKIM handles the halal certification process for products for the domestic market and international market. JAKIM's Halal logo is among the most widely recognized and respected symbols of halal compliance in the world. At the state level, the certification authorities are the State Islamic Religious Department (JAIN) and The State Islamic Religious Council (Majlis Agama Islam Negeri -JAIN) and State Islamic Religious Council (Majlis Agama Islam Negeri - MAIN) who are given the authority to issue the halal certificate for domestic market. In addition to meeting Halal requirements, food manufacturers in Malaysia are encouraged to adopt and maintain standards that meet global benchmarks such as ISO 9000, Codex Alimentarius, Quality Assurance Program, Hazard Analysis and Critical Control Points (HACCP), Good Hygiene Practice (GHP), and Sanitation Standard Operating Procedure (SOP).[60]

The global halal food trade in Malaysia is estimated at over USD 600 billion every year. Halal certification such as that issued by JAKIM is a powerful marketing tool for both food stores and food product manufacturers. The relationship between halal food products and food safety and hygiene has a universal impact and is approved not only by Muslims but also non-Muslims. Standards and certification ensure that manufacturers act responsibly to maintain the halal status of their products during all stages of production, from the raw materials and ingredients used to the processing and distribution of products.[61]

Standards in Malaysia's halal tourism sector have an important role to play in building Malaysia's credibility in the global halal trade and tourism industry through simplifying best practices, creating systematic development and avoiding abuse and misuse by irresponsible and profit-motivated operators. The existence and adherence to standards and guidelines in a country is important and non-negotiable if it is to attract Muslim visitors because it increases visitor confidence in the country's products and services, thus increasing the country's attractiveness and value as a tourist destination in the eyes of Muslim visitors.

Homestay is a sub-sections of community based tourism activities. It offers tourists the to stay, dine, and be entertained by their respective community as a member of the family, doing activities and celebrating traditional events together.1 A homestay can be an alternative home for tourists that need different accommodation styles. In Malaysia,

[59] Islamic Tourism Standards – Islamic Tourism Centre of Malaysia | ITC

[60] The Concept Of Muslim Friendly Tourism And Its Implementation In Malaysia, Zahrah Fatimah Ariff Irshad1a*, Noorul Huda Sahari2b and Anis Husna, Academy of contemporary Islamic Studies, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, MALAYSIA

[61] Ibid

a homestay program has been announced as rural and cultural-community-based tourism since 1995. These activities aim to develop rural communities, to reduce economic imbalances between rural and urban areas as well as to ensure ethnic communities participation in tourism activities.[62]

The traditional homestay type offers guests eating, cooking, and other activities, exchanging and learning from each other's cultures.5 It is mainly operated and organized by Kampong (village) people together with the Village Development and Security Committee (JKKK), which cooperates with local culture, customs, and activities. Furthermore, it offers tourists to experience by themselves the multi-ethnic life condition with cultural experiences. The host of the homestay will make sure of the cleanliness for comfort and safety. Even though homestay is a part of a shelter called a house, theremust be a shariah guideline or principle to be adapt into the homestay itself.[63]

Islam has statedfew guidelines to be followed. Firstly, a house is a basic ofsociety. Islam also regards the house as a place of expressionand strengthening family relationship. Therefore, designer shouldbuilt and design the house according to shariah for the dwellers.House also have should be built to give privacy to the dwellersas the prophet Sunnah stress the importance of the privacy of thehome. Purification is important to the muslims. So that, a houseshould stressed the cleanliness in every part of the home. More-over, designing a house should avoid wastage and be as simpleas possible. Safety is important to ensure the dwellers are notin harm or danger. The interior should reflect a humbleness andmoderate lifestyle of a Muslim dweller.[64]

The results of the author's research in Penang City on October 29 2022, as an example of halal tourism in Penang City, Malaysia, homestay owners pay close attention to Muslim friendly standards set out in terms and conditions that must be obeyed by every homestay visitor. Such as not being allowed to bring pets such as dogs and the separation of cutlery for Muslim and non-Muslim visitors. There is a special homestay area in Aur City which consists of community houses that are rented out to both local and foreign tourist visitors. The homestay area still pays attention to halal standards, and is guaranteed by the Government of Malaysia with a plaque from the government agency that guarantees cleanliness, service, and hospitality. Homestay owners are given training and outreach about attracting tourists, and the Government of Malaysia is also providing incentive funds for homestay repairs to homestay owners. The Malaysian Government's support for halal tourism has been regulated with good regulations and is also manifested in providing support as concrete evidence.

If the same thing is applied to halal tourism in Indonesia, it will get greater attention and also with the support of a mandate from the central government. The problem is, there is no supreme legal umbrella that regulates the implementation of halal tourism in Indonesia, although in some regions there are regional regulations related to the implementation of halal tourism but only apply regionally in that area. The need for new breakthroughs in the process of formulating and ratifying halal tourism laws in order to realize Indonesia's aspirations to become a halal tourist destination with the first order in the world among other countries. Short-term strategy (quick win strategy), local governments can formulate regional regulations on Halal Tourism and ratify them

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[62] *(PDF) Muslim-Friendly's Homestay in Malaysia: Issues and Challenges*. Available from: https://www.researchgate.net/publication/283800378_Muslim-Friendly's_Homestay_in_Malaysia_Issues_and_Challenges [accessed Apr 01 2023].

[63] Ibid

[64] Z. B. Yusof, Islamic Guiding Principle (Shari'ah Law) For ArchitecturalInterpretation OfHousing, (2014), https://www.academia.edu/2451723/islamic_guiding_principle_shariah_law_for_architectural_interpretation_of_housing.Accessed 25 Maret 2023

together with local people's representatives, then regional leaders become the spearhead of formulating their implementation so that they have competitiveness in increasing regional tourism. This program is part of the main quick wins of the economic master plan (APBN) and the Regional Revenue and Expenditure Budget (APBD). Apart from funding, there are also limitations in terms of Human Resources (HR) and government expertise in building and managing basic infrastructure.

1. KESIMPULAN

a. The development of halal tourism is a must if Indonesia wants to attract foreign tourists from the Middle East region which are Muslim countries. These countries are the countries with the largest tourism travel expenses. Compared to Malaysia, Malaysia has a well-developed halal industry and a wide network of halal restaurants throughout the country with centralized, well-systematic regulations. The success of the Malaysian halal industry is largely due to the development of halal standards and a systematic system of halal assurance implemented nationwide. These standards have played an important role in building Malaysia's credibility in the global halal trade and tourism industry. If the same thing is applied to halal tourism in Indonesia, it will get greater attention and also with the support of a mandate from the central government. The problem is, there is no highest legal umbrella that regulates the implementation of halal tourism in Indonesia. The need for new breakthroughs in the process of formulating and ratifying halal tourism laws in order to realize Indonesia's aspirations to become a halal tourist destination with the first order in the world among other countries.

b. The need to strengthen legal factors in terms of legal substance not only in the form of regional regulations, namely Regional Regulations but the Central Government needs to issue technical regulations including PP or Permen to strengthen and provide legal clarity to the concept of halal tourism technically so that there are no misperceptions among the public, causing rejection for the implementation of the halal tourism concept. That the concept of halal tourism can be accepted better if it uses the term or concept of Muslim Friendly Tourism. Apart from that, arrangements provide space for strengthening regional institutions in tourism management. Structural factors through capacity building and active coordination of related institutions. Factors of supporting facilities or facilities need to be realized by sharia tourism training institutions, efficient administrative processes, and the addition and development of halal tour guides. Community factors and cultural factors are addressed by optimizing community empowerment, can use socialization methods or intense mentoring involving all elements, educational institutions and non-governmental organizations. In order to develop and improve halal tourism in Indonesia, it is necessary to develop a new paradigm regarding the concept of halal tourism in Indonesia. This is so that the concept of halal tourism can be accepted by non-Muslim Indonesians

Lampiran 4 –Draft Outline Buku Ajar

PENGEMBANGAN KERANGKA HUKUM BARU UNTUK PARIWISATA BERBASIS KOMUNITAS DI DANAU TOBA DENGAN KONSEP WISATA HALAL
(DEVELOPING A NEW LEGAL FRAMEWORK FOR COMMUNITY-BASED TOURISM IN LAKE TOBA: THE CASE OF HALAL TOURISM)
HUKUM KEPARIWISATAAN: WISATA HALAL DALAM TEKS DAN KONTEKS

Kata Sambutan Ketua Tim Peneliti-USU
Kata Sambutan Ketua Tim Peneliti-UiTM Cawangan Penang
Kata Sambutan Dekan Fakultas Hukum-USU
Daftar Isi
Daftar Istilah

1. Pengantar Hukum Kepariwisataan
   1.1.Seputar Pariwisata
   1.2.Usaha Homestay di daerah Tujuan Wisata
   1.3.Pengaturan Hukum Kepariwisataan di Indonesia
   1.4.Komparasi Pengaturan Hukum Kepariwisataan di Indonesia-Malaysia dalam Program *Homestay* Kementerian Pariwisata
2. Situasi dan Kondisi Pariwisata di Sumatera Utara dalam kawasan Danau Toba
   2.1. Profil Wisata di Kabupaten Toba
   2.2. Profil Wisata di Kabupaten Simalungun
   2.3. Profil Wisata di Kabupaten Samosir
3. Paradigma wisata Halal si Sumatera Utara (Toba, Samosir dan Simalungun)
   3.1. Konsepsi Wisata Halal
   3.2. Paradigma masyarakat kawasan Danau Toba tentang Pariwisata
   3.3. Tantangan inisiatif pemerintah Provinsi Sumatera Utara dalam pengembangan wisata Halal di Kawasan Danau Toba
4. Pengembangan Konsep wisata *"Halal atau Moslem Friendly"*?
   4.1. Konsep wisata halal di ASEAN (Malaysia, Singapura, Jepang, Thailand dan Taiwan)
   4.2. Perdebatan Konsep wisata *"Halal* dan *Moslem Friendly"*
   4.3. Replikasi Model wisata Halal Untuk Kawasan Danau Toba-Sumatera Utara-Indonesia
5. Masyarakat dan Pengembangan Pariwisata Berbasis Komunitas di Kawasan Danau Toba
   5.1. Pandangan masyarakat di 3 kabupaten Kawasan Danau Toba tentang wisata Halal
   5.2. Peran Masyarakat dalam pengembangan wisata Halal; Tantangan dan Hambatan
   5.3. Pemberdayaan Masyarakat bagi pengembangan bisnis wisata halal di kawasan Danau Toba.
6. Penutup
   6.1.Kesimpulan
   6.2.Saran

Daftar Pustaka

Kode Talenta/ Kode Fakultas : 01/10

Menyasar SDGs No : 3

LAPORAN AKHIR

PENELITIAN TALENTA USU

SKEMA PENELITIAN KOLABORASI INTERNASIONAL

MODEL PREDIKSI RISIKO KERENTANAN SOSIAL TERHADAP KEJADIAN DIABETES MELLITUS TYPE 2: MULTILEVEL ANALYSIS

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Universitas Sumatera Utara
Tahun Anggaran 2022
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FAKULTAS KESEHATAN MASYARAKAT

UNIVERSITAS SUMATERA UTARA

MARET 2023

Halaman Pengesahan Laporan Akhir
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RINGKASAN

Model Prediksi Risiko Kerentanan Sosial Terhadap Kejadian Diabetes Mellitus Type 2; Analisis Multilevel.

Diabetes mellitus adalah masalah kesehatan global dan berdampak pada kualitas sumber daya manusia. Data IDF menunjukkan terdapat 463 juta usia dewasa 20-79 tahun menderita diabetes pada tahun 2020, meningkat menjadi 537 juta pada tahun 2021. Diprediksi jumlah penderita diabetes meningkat menjadi 643 juta pada 2030 dan 783 juta pada tahun 2045. Sebagian penderita diabetes mellitus (80%) dalam bentuk diabetes mellitus type 2 dan umumnya tidak terdiagnosis (50,1%). Prevalensi diabetes mellitus di Indonesia pada tahun 2021 menempati urutan kelima dengan prevalensi 10,6%. Propinsi Sumatera Utara menduduki urutan ke 13 kasus diabetes mellitus tertinggi di Indonesia dengan prevalensi sebesar 2,3%. Di Kota Medan tahun 2021 jumlah penderita diabetes mellitus sebesar 39843 penderita. Berbagai faktor berkontribusi pada kejadian diabetes mellitus, antara lain faktor karakteristik individu, sosial, gaya hidup, dan lingkungan. Pengendalian diabetes mellitus didasarkan pada faktor risiko diabetes mellitus. Model prediksi diabetes mellitus perlu untuk intervensi dan pencegahan diabetes mellitus. Penelitian bertujuan menentukan model prediksi risiko kerentanan sosial terhadap terjadinya Diabetes mellitus type 2. Penelitian bersifat observational dengan disain *cross sectional* dilakukan dalam Agustus-Desember 2022. Data dianalisis dengan uji *multilevel regresi logistic.* Dari hasil penelitian diperoleh mayoritas responden berumur 46-60 tahun sebesar 791%. perempuan sebesar 80,1%, suku batak sebesar 50,3%, pendidikan PT sebesar 45,6%, penghasilan >3,3 juta sebesar 56,8%. Sebesar 43,2% memiliki riwayat diabetes dalam keluarga, memiliki riwayat hipertensi dalam keluarga 36,1%, dan 38,5% menderita hipertensi. Memiliki IMT kategori obesitas sebesar 68,9%, lingkat perut berisiko sebesar 70,5% , hipertensi sistolik 39,5% dan kolesterol tinggi sebesar 57,1%. Hasil uji regresi logistic multivariate diperoleh umur, jumlah penghasilan, riwayat keluarga menderita diabetes mellitus, menderita tekanan darah sistolik tinggi , kebiasan merokok dan tingkat pendidikan kepala rumah tangga berkontribusi terhadap kejadian diabetes mellitus dengan persamaan model prediksi Y=1,312 +1,331umur+ 0,790 penghasilan keluarga + 1.764 riwayat menderita DM+1.784 menderita TD sistolik tinggi +1.460 kebiasaan merokok+ 0.571 pendidikan kepala RT. Dari analisis multilevel regresi didapat 50,0% variasi dalam kejadian diabetes mellitus ditentukan oleh karakteristik rumah tangga dan variabel umur, riwayat diabetes dalam keluarga, penghasilan, menderita tekanan darah sistolik tinggi, kebiasaan merokok dan pendidikan Kepala RT memberi kontribusi sebesar 51,7% pada variabilitas kejadian diabetes mellitus

Kata kunci: Diabetes mellitus, kerentanan sosial, prediksi, multilevel.

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Dalam proses penelitian ini, penulis tidak terlepas dari bimbingan, bantuan Serta dukungan dari berbagai pihak, dalam kesempatan ini perkenankanlah penulis mengucapkan terima kasih yang tidak terhingga kepada:

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Medan, April 2023

Penulis

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BAB 1. PENDAHULUAN

1.1.Latar belakang

Diabetes Mellitus merupakan masalah kesehatan masyarakat global dengan prevalensi tinggi dan berdampak pada kualitas hidup manusia. Data Organisasi Federasi Diabetes International (IDF), menunjukkan tahun 2020 terdapat 463 juta penderita diabetes mellitus (IDF, 2020) dan pada tahun 2021 terdapat 537 juta penderita diabetes mellitus. Diprediksi tahun 2030 jumlah penderita diabetes mellitus meningkat menjadi 643 juta dan tahun 2045 menjadi 783 juta (IDF, 2021). Sebagian besar penderita diabetes mellitus (81%) tinggal di negara berpenghasilan rendah dan menengah, dalam bentuk diabetes mellitus type 2 dan tidak terdiagnosis (IDF, 2021).

Data Kementrian Kesehatan menunjukkan, Indonesia menempati urutan ketujuh negara prevalensi diabetes tertinggi didunia dengan prevalensi sebesar 6,2% atau jumlah penderita sebesar10,7 juta (Kemenkes, 2020), pada tahun 2021 menempati urutan kelima dengan prevalensi 10,6% atau jumlah penderita 19,47 juta (IDF, 2021). Data Riset Kesehatan Dasar, prevalensi diabetes mellitus di Indonesia sebesar 10,9 % (Riskesdas, 2018).

Propinsi Sumatera Utara menempati urutan ke 13 prevalens diabetes mellitus tertinggi di Indonesia dengan prevalensi 2,3% (Kemenkes, 2018). Pada tahun 2020 di Propinsi Sumatera Utara jumlah penderita diabetes mellitus sebesar 161.267 orang (Profil kesehatan Sumatera jutara, 2020) dan pada tahun 2021 sebesar 1033076 orang (Profil kesehatan Sumatera Utara, 2021). Kota Medan merupakan salah satu kabupaten /kota dengan prevalensi diabetes mellitus yang tinggi dan pada tahun 2021 di Kota Medan jumlah penderita sebesar 39843 orang(Profil kesehatan, Kota Medan, 2021).

Diabetes mellitus dipengaruhi faktor individu seperti riwayat diabetes mellitus dalam keluarga, kebiasaan merokok, stress, dan pola makan tidak sehat (Murad, 2014; Tjekyan (2014). Penelitian Budiarti et al. (2016) mendapatkan aktivitas fisik berhubungan dengan kejadian diabetes mellitus type 2. Orang melakukan aktivitas fisik teratur cenderung memiliki berat badan normal dan bermanfaat mengontrol kadar gula darah (Caballero, 2018).

Faktor risiko individu saja tidak mencukupi untuk memahami perbedaan prevalensi kejadian diabetes type 2 dalam populasi (Bravo et al, 2018). Penelitian akhir ini menunjukkan faktor karakteristik kontekstual di mana individu tinggal berkaitan dengan kejadian diabetes mellitus type 2 (Auchincloss et al, 2013). Karakteristik seperti tingkat kemiskinan, lingkungan dengan area hijau yang lebih rendah, dan ketersediaan makanan siap saji yang besar dikaitkan dengan prevalensi diabetes yang lebih tinggi (Astell-Burt, 2014; den Braver, 2018), sementara lingkungan perumahan dengan sarana olah raga yang memadai untuk aktivitas fisik dikaitkan dengan rendahnya insiden diabetes mellitus type 2 (Haynes,2017). Hal ini juga didapati di tempat dengan pendapatan dan pendidikan lebih tinggi (Christineet al, 2015).

Pendekatan ekologis mempelajari faktor terkait dengan diabetes mellitus melalui analisis kemampuan di tingkat masyarakat dari konteks ekonomi dan sosial di mana individu hidup dan mengalami situasi yang berhubungan dengan kesehatan (Faka et al, 2017).

Model prediksi diabetes mellitus telah dikembangkan, meliputi berbagai faktor risiko seperti umur, jenis kelamin, etnis, kadar gula darah puasa, tekanan darah sistolik, kadar

kolesterol, indeks massa tubuh, riwayat diabetes mellitus dalam keluarga menghasilkan point prediksi yang memiliki kekuatan prediksi kriteria diagnostik untuk sindroma metabolik (Chien, K et al, 2009).

Pencegahan diabetes mellitus merupakan prioritas utama kesehatan masyarakat. Pemahaman yang baik akan faktor risiko terkait kejadian diabetes mellitus adalah penting dalam memandu pengembangan strategi pencegahan diabetes mellitus yang efektif pada pencegahan morbiditas dan mortalitas diabetes mellitus. Selain itu model prediksi risiko diabetes mellitus membantu untuk memandu skrining dan intervensi. Dengan demikian perlu dilakukan penelitian untuk menganalisis pengaruh risiko kerentanan sosial terhadap terhadinya diabetes mellitus type 2 dan menentukan model prediksinya.

1.2.Perumusan Masalah

Prevalensi diabetes cenderung meningkat. Faktor sosial dan lingkungan berperan dalam peningkatan jumlah penderita diabetes mellitus. Prediksi kejadian diabetes mellitus perlu dalam memandu skrining dan pencegahan. Penanggulangan difokuskan pada faktor berisiko.

1.3.Tujuan Khusus Penelitian

1. Menentukan prevalensi diabetes mellitus
2. Menentukan pengaruh faktor compositional terhadap kejadian diabetes mellitus
3. Menganalisis pengaruh faktor contextual terhadap kejadian diabetes mellitus
4. Menganalisis pengaruh faktor compositional dan contextual terhadap kejadian diabetes mellitus
5. Menentukan model prediksi diabetes mellitus

1.4. Urgensi Penelitian

Penelitian ini termasuk bidang unggulan kompetitif TALENTA. Diharapkan akan diperoleh informasi untuk pengembangan ilmu pengetahuan dalam upaya pencegahan dan pengendalian penyakit diabetes mellitus melalui penerapan model prediksi kejadian diabetes mellitus.

1.5. Rencana Target Pencapaian

Tabel Rencana Target Luaran adalah sebagai berikut :

No	Jenis Luaran	Nama Jurnal, Nama Konferensi/ Jenis KI, Judul Buku Ajar
	Luaran Wajib	
1	Artikel di jurnal internasional bereputasi	Journal of health research
2	Artikel di jurnal nasional terakreditasi.	
3	Hak Kekayaan Intelektual	
4	Artikel di prosiding internasional terindeks bereputasi	
	Luaran Tambahan	
1	Artikel di prosiding internasional terindeks bereputasi	Proceeding terindeks ICOPH TCD 2022
2	Artikel di jurnal nasional	
3	Hak Kekayaan Intelektual	
4	Produk/TTG/ Model/ Karya Seni	
5	Buku Ajar	Bahan ajar Diabetes, faktor risiko dan pencegahan

BAB 2. TINJAUAN PUSTAKA

2.1. Definisi Diabetes Mellitus

Diabetes mellitus adalah penyakit metabolik yang berlangsung khronis yang ditandai dengan hyperglikemik kronik akibat gangguan sekresi insulin yang dapat berdampak pada kerusakan saraf dan pembuluh darah (Perkeni, 2015).

2.2. Epidemiologi Diabetes Mellitus

Penyakit diabetes mellitus merupakan penyakit tidak menular dengan prevalensi yang cenderung meningkat dari tahun ke tahun. Data dari Organisasi International Diabetes Federation (2020), terdapat 463 juta orang dewasa menderita diabetes dan jumlah ini meningkat menjadi 537 juta pada tahun 2021. Diprediksi pada tahun 2030 jumlah penderita diabetes mellitus meningkat menjadi 643 juta dan pada tahun 2045 akan meningkat menjadi 783 juta penderita (IDF, 2021). Sebagian penderita (80,1%) tinggal di negara berpenghasilan rendah dan menengah, dalam bentuk diabetes mellitus type 2 dan tidak terdiagnosis.

Data Riset Kesehatan Dasar menunjukkan prevalensi diabetes mellitus di Indonesia meningkat dari 6,9 % pada tahun 2013 menjadi 10,9% pada tahun 2018 (Riskesdas, 2018). Penyakit Diabetes mellitus merupakan penyebab kematian ketujuh didunia dengan jumlah kematian sebesar 6,7 juta kematian (IDF, 2021). Indonesia menempati urutan kelima negara didunia dengan jumlah penderita diabetes mellitus yang tinggi dengan jumlah penderita 19,47 juta atau prevalensi sebesar 10,6% (IDF, 2021). Propinsi Sumatera Utara menempati urutan ke 13 prevalens diabetes mellitus tertinggi di Indonesia dengan prevalensi 2,3 % (Profil kesehatan Sumatera utara, 2021). Jumlah penderita diabetes mellitus pada tahun 2021 sebesar 1033076 orang (Profil kesehatan Sumatera utara, 2021) dan di Kota Medan pada tahun 2021 jumlah sebesar 39843 orang (Profil kesehatan Kota Medan, 2021). Prevalensi diabetes mellitus mengalami peningkatan seiting bertambahnya usia dengan puncaknya pada umur 55-64 tahun dan menurun setelah rentang umur tersebut.

2.3. Klasifikasi Diabetes Mellitus (Perkeni, 2015)

Diabetes melitus dapat diklasifikasikan berdasarkan *American Diabetic Association* adalah sebagai berikut :

a. Diabetes melitus Type I

Diabetes melitus type I ini terjadi karena kerusakan sel ß pancreas sehingga produksi insulin tidak ada sama sekali. Insulin adalah hormon yang dihasilkan pankreas untuk mencerna gula darah. Diabetes tipe ini merupakan Diabetes yang tergantung insulin dan membutuhkan asupan insulin dari luar tubuhnya .

b. Diabetes melitus Type II.

Diabetes tipe ini merupakan penyakit diabetes yang paling banyak dijumpai (90%). Pada tipe ini terjadi resistensi insulin atau tidak adekuatnya respon sel ß pancreas yang disertai penurunan sekresi insulin oleh sel ß pancreas .

c. Diabetes gestasional

Diabetes tipe ini ditandai oleh kenaikan kadar gula darah pada selama kehamilan. Pada umumnya wanita hamil yang mengalami Diabetes memiliki kadar glukosa tinggi pada 24minggu kehamilan dan kadar gula darah akan kembali normal setelah melahirkan

.

2.4.**Faktor Risiko Diabetes melitus (Kemenkes 2020; Perkeni 2015).**

Faktor resiko terjadinya diabetes mellitus meliputi faktor risiko yang tidak dapat diubah dan faktor risko yang dapat diubah. Yang termasuk faktor risiko yang tidak dapat diubah adalah umur, jenis kelamin, dan memiliki riwayat keluarga dengan diabetes, riwayat melahirkan anak diatas 4000 gram. Sedangkan faktor risiko yang dapat diubah berkaitan erat dengan perilaku hidup yang kurang sehat seperti pola makan yang tidak sehat, kurangnya aktifitas fisik, berat badan lebih, obesitas sentral/abdominal, riwayat hipertensi, riwayat kadar kolesterol yang tinggi, kebiasaan merokok, konsumsi alkohol, dan stress.

2.5.**Tanda dan Gejala Diabetes Mellitus (Kemenkes 2020; Perkeni 2015).**

Trias gejala klasik diabetes melitus meliputi sering buang air kecil (poliuri), mudah lapar (polifagia), sering merasa haus (polidipsi), penurunan berat badan tanpa sebab, dan tanda lain seperti kesemutan, gatal di daerah genitalia, penglihaan kabur, keputihan pada wanita, mudah ngantuk, luka sulit sembuh bisul yang sering timbul dan disfungsi ereksi.

2.6.Diagnosa Diabetes mellitus (Kemenkes 2020; Perkeni 2015)

Penegakkan diagnosa diabetes melitus didasarkan pada hasil pemeriksaan kadar glukosa darah**.** Sebelumnya dilakukan pemeriksaan uji screening untuk deteksi dini faktor risiko diabetes. Kriteria Diagnosis ditegakkan berdasarkan 4 hal:

a. Pemeriksaan kadar gula darah sewaktu puasa > 126 mg/dl
b. Pemeriksaan kadar gula darah sewaktu ≥200 mg/dl
c. Pemeriksaan kadar gula darah 2 jam post prandial ≥200 mg/dl
d. Pemeriksaan Hb1AC ≥ 6,5 % dengan menggunakan metode yang terstandarisasi

2.7 Pencegahan dan Penanggulangan Diabetes mellitus (Kemenkes, 2020).

Pencegahan dan pengendalian diabetes ditujukan agar orang yang sehat tetap sehat, orang yang berisiko tidak berkembang menjadi pendertia diabetes dan orang yang sudah menderita diabetes tidak mengalami komplikasi. Pencegahan diabetes diprioritaskan pada upaya prevensi primer terutama pada populasi berisiko. Dalam program pengendalian diabetes, pemerintah mengintegrasikan beberapa kegiatan yakni melaksanakan posbindu PTM dengan melibatkan peran serta masyarakat dan kegiatan pemantauan faktor risiko penyakit tidak menular yang terintegrasi di fasilitas pelayanan primer.

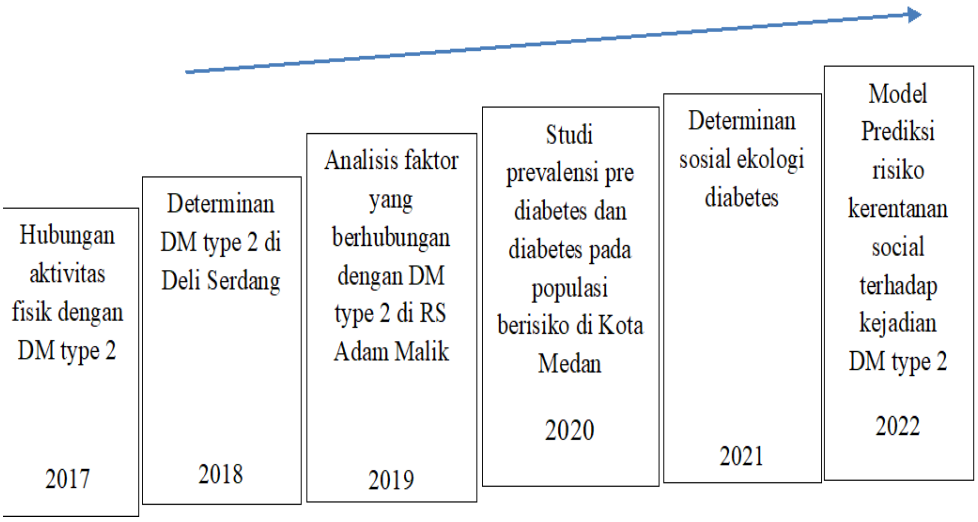
Penelitian yang telah dilakukan oleh pengusul sebagai penelitian pendahuluan dan menjadi dasar pengusulan peneitian ini dapat dilihat pada tabel berikut:

No	Tahun	Tema	Peneliti
1	2017	Hubungan Aktivitas fisik dengan kejadian DM type II pada usia lanjut di Kota Medan	dr Fazidah A Siregar MKes,PhD
2	2018	Determinan kejadian DM type II Di RSU Kabupaten Deli Serdang	dr Fazidah A Siregar MKes,PhD
3	2019	Analisis faktor yang berhubungan dengan kejadian diabetes mellitus type di RS Adam Malik	dr Fazidah A Siregar MKes,PhD
4	2020	Studi prevalensi pre Diabetes, Diabetes mellitus kelompok populasi berisiko di Kota Medan	dr Fazidah A Siregar MKes,PhD
5	2021	Determinan sosial ekologi penderita diabetes mellitus	dr Fazidah A Siregar MKes,PhD

Oleh karena itu pada kesempatan ini, peneliti mengusulkan penelitian dengan tema : Model Prediksi Risiko Kerentanan Sosial Terhadap Kejadian Diabetes Mellitus Type 2: Multilevel analysis

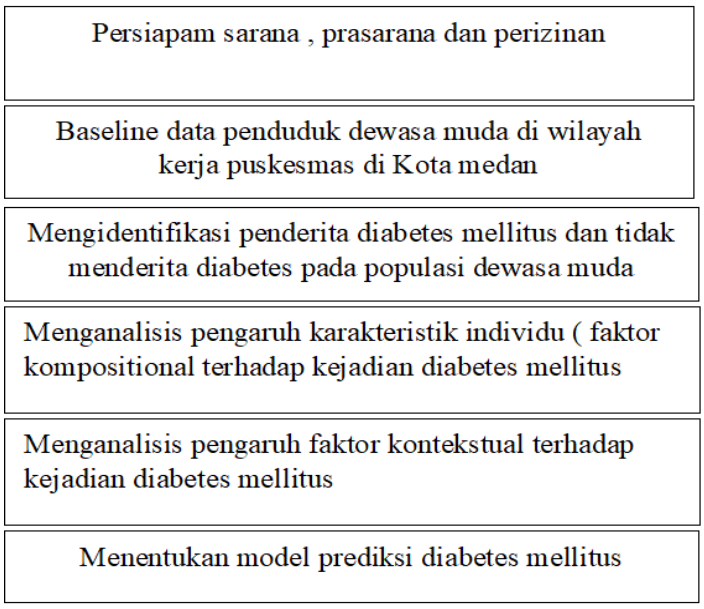
2.8.Road Map Penelitian

Road Map penelitian adalah sebagai berikut :



BAB 3. METODE PENELITIAN

Bagan Alir Penelitian dijelaskan pada gambar



3.1. Jenis dan Rancangan Penelitian

Penelitian ini berupa penelitian observational dengan pendekatan *cross sectional study*. Tujuan penelitian untuk menentukan prevalensi penderita diabetes mellitus type 2, mengidentifikasi pengaruh risiko kerentanan sosial terhadap terjadinya DM type 2 dan menentukan model prediksi diabetes mellitus type 2. Penelitian dimulai dengan melakukan identifikasi kejadian diabetes mellitus type 2 pada populasi dewasa muda. Kemudian dilakukan wawancara untuk mengidentifikasi pengaruh risiko kerentanan sosial (karakteristik individu dan kontekstual) terhadap kejadian diabetes mellitus type 2 di wilayah kerja puskesmas di Kota Medan dan menentukan model prediksi diabetes mellitus type 2.

3.2. Lokasi dan Waktu Penelitian

Penelitian ini dilakukan di beberapa wilayah kerja puskesmas di Kota Medan. Pemilihan puskesmas dilakukan secara *purposive sampling* berdasarkan lokasi geografis puskesmas. Penelitian dilakukan selama 6 bulan mulai Juli s/d Desember 2022

3.3. Populasi dan Sampel

Populasi dalam penelitian ini penduduk dewasa muda yang tinggal di wilayah kerja puskesmas yang ada di Kota Medan. Sampel dalam penelitian ini adalah penduduk dewasa yang menderita diabetes mellitus dan tidak menderita diabetes mellitus yang tinggal di 4 wilayah kerja puskesmas yang dipilih secara purposive sampling berdasarkan lokasi geografi (perkotaan dan

pinggir kota) Dari masing puskesmas dipilih penduduk dewasa berusia 30- 60 tahun sebanyak 50 orang, sehingga total sampel 200 orang

3.4. Variabel Penelitian

Variabel dalam penelitian ini terdiri dari variabel independen dan variabel dependen. Variavel dependennya adalah kejadian diabetes mellitus type 2. Variabel independennya meliputi variabel karakteristik individu (umur,jenis kelamin, status perkawinan, pendidikan,pekerjaan, BMI, lingkar perut, tekanan darah, kadar gula darah, kadar kolesterol, aktivitas fisik, kebiasaan merokok, konsumsi alkohol, konsumi buah dan sayur, kebiasaan makan makanan/ minum manis) dan faktor kontekstual (kepadatan penduduk, jumlah fasilitas olah raga, kepadatan hunian, pendapatan keluarga, kepadatan tempat penjualan makanan).

3.5. Cara Pengumpulan Data

Pengumpulan data diawali dengan melakukan skrining pada penduduk dewasa muda meliputi pengukuran tinggi badan, berat badan untuk menentukan IMT, pengukuran lingkar pinggang, pemeriksaan tekanan darah, kadar gula darah, dan kadar kolesterol darah. Kemudian dilanjutkan dengan wawancara menggunakan kuesioner terstruktur yang sudah divalidasi yang mencakup informasi karakteristik individu dan kontekstual. Pengumpulan data dilakukan dalam rentang waktu Juli 2022 hingga September 2022. Sebelumnya uji validasi instrument dilakukan pada 30 orang yang memiliki karakteristik yang sama yang bertempat tinggal di wilayah kerja puskesmas di Kota Medan.

Pengukuran tekanan darah dilakukan oleh dokter / tenaga kesehatan dengan menggunakan tensimeter Merk Omron. Pengukuran tekanan darah dilakukan sebanyak 2 kali dengan interval 5 menit. Kemudian kedua hasil pengukuran dirata-ratakan. Tekanan darah tinggi jika tekanan darah sistolik ≥ 140 mgHg, pre hipertensi jika tekanan darah sistolik 120-139 mmHg dan tekanan darah normal jika tekanan darah sistolik < 120 mmHg.

Pemeriksaan kadar gula darah puasa menggunakan Auto Check. Diabetes didefinisikan jika KGD > 126 mg/dl, prediabetes jika KGD 100-125 mg/dl dan normal jika KGD < 100 mg/dl. Pemeriksaan kolesterol darah dilakukan pada saat puasa, kolesterol total tinggi jika ≥200 mg/dl dan normal jika < 200 mg/dl.

Pengukuran tinggi badan dengan menggunakan Microtoise dengan panjang 2 meter dan ketelitian 0,1 cm. Pengukuran berat badan dengan menggunakan timbangan digital merek Kris dengan kapasitas 150 kg dan ketelitian 50 gram. Pengukuran tinggi badan dan berat badan untuk menentukan indeks massa tubuh. Pengukuran lingkar perut menggunakan pita ukur untuk mendeteksi adanya obesitas sentral.

3.6. Analisa Data

Pada penelitian ini, data dianalisa secara univariat, bivariat dan multivariat dengan tahapan sebagai berikut :

1. Analisis Univariat

Pada analisis univariat, masing masing variabel independen dianalisis secara deskriptif dan disajikan dalam bentuk tabel frekwensi, grafik, pie chart.

2. Analisis Bivariat dan multivariat

Analisis bivariat bertujuan untuk mengetahui pengaruh masing masing variabel independen (faktor karakteristik individu dan faktor kontekstual) dengan kejadian diabetes mellitus type 2 . Analisis menggunakan *Simple regresi logistic*.

3. Analisa multivariat

Analisa multivariat dengan *regresi logistic multilevel* untuk menilai pengaruh faktor kontekstual terhadap faktor karakteristik tingkat individual dalam terjadinya diabetes mellitus type 2. Variabel yang terletak pada level satu langsung berpengaruh terhadap individu dan besarnya pengaruh pada level satu ditunjukkan oleh koefisien regresi (b). Sementara besarnya pengaruh pada level dua dan tiga ditunjukkan oleh parameter *Intra Class Corelation* (ICC).

Susunan Organisasi Tim Pengusul dan PembagianTugas

No	Nama / NIDN	Fakultas/ Unit	BidangIlmu	UraianTugas
1	dr Fazidah Aguslina Siregar MKes, PhD	FKM USU	Epidemiologi	Penanggung Jawab keseluruhan tahap penelitian - Melakukan koordinasi dengan semua komponen yang terlibat dalam penelitian - Memastikan tim bekerja tepat waktu - Membuat laporan - Mempresentasikan hasil penelitian
2.	Dr Asfriyati SKM, MKes	FKM USU	Biostatistik dan Kependudukan	- Menyiapkan persiapan lapangan, sarana dan prasaranan - Mengkoordinir tim dalam pengumpulan data
3	Dra Nurmain M.KM, Ph.D	FKM USU	Kesehatan lingkungan	- Menyiapkan instrument penelitian - Uji validasi instrument penelitian

4	Izza Dienillah Saragih,SKM,M.Epid	FKM USU	Epidemiologi	- Pengumpulan data - Analisa data - Membuat laporan

Mahasiswa dilibatkan sebanyak 3 orang dengan tugas :

a. Membantu dalam menyusun instrument penelitian
b Membantu dalam validasi instrument penelitian
c Membantu dalam kegiatan pengumpulan data di lapangan
d. Membantu dalam kegiatan entri data dan analisa data

BAB 4 HASIL DAN PEMBAHASAN

Pada laporan akhir semua tahapan kegiatan telah dilaksanakan dan analisa data telah dilakukan dan hasil digambarkan seperti terlihat pada tabel dibawah;

4.1. Analisis Univariat

4.1.1. Karakteristik Responden

4.1.1.1 Karakteristik responden berdasarkan umur

Tabel 1. Distribusi responden berdasarkan umur

	n	Minimum	Maksimum	Mean	SD
Umur	296	33	60	51,67	6,22

Dari tabel diatas terlihat dari responden sebanyak 296 orang , umur minimum 33 tahun, umur maksimum 60 tahun , dengan umur rata-rata sebesar 51,67 tahun dengan standar deviasi 6,22.

Tabel 2. Distribusi responden berdasarkan kategori umur

Kategori umur	Frekuensi	Persentase (%)
30-45 tahun	62	20,9
46-60 tahun	234	79,1

Dari tabel diatas terlihat responden dengan kategori umur 30-45 tahun sebesar 62 orang (20,9%), dan kategori umur 46-60 sebesar 234 orang (79,1%).

4.1.1.2 Distribusi responden berdasarkan kategori jenis kelamin

Tabel 3. Distribusi responden berdasarkan kategori jenis kelamin

Jenis Kelamin	Frekuensi	Persentase (%)
Laki-laki	59	19,9
Perempuan	237	80,1

Dari tabel diatas terlihat responden laki-laki sebesar 59 orang (19,9%), dan responden perempuan sebesar 237 orang (80,1%).

4.1.1.3 Distribusi responden berdasarkan status perkawinan

Tabel 4. Distribusi responden berdasarkan status perkawinan

Status Perkawinan	Frekuensi	Persentase (%)
Kawin	254	85,8
Tidak Kawin	4	1,4

Janda/Duda	38	12,8

Dari tabel diatas terlihat responden yang kawin sebesar 254 orang (85,8%), responden yang tidak kawin sebesar 4 orang (1,4%) dan responden yang janda/duda sebesar 38 orang (12,8%).

4.1.1.4. Distribusi responden berdasarkan suku

Tabel 5. Distribusi resonden berdasarkan suku

Suku	Frekuensi	Persentase (%)
Jawa	68	23,0
Batak	149	50,3
Mandailing	35	11,8
Melayu	7	2,4
Minang	14	4,7
Lain-lain	23	7,8

Dari tabel diatas terlihat responden suku batak sebesar 149 orang (50,3%), suku jawa sebesar 68 orang (23,0%), suku mandailing sebesar 35 orang (11,8%), suku minang sebesar 14 orang (4,7%), dan lain-lain sebesar 23 orang (7,8%).

4.1.1.5. Distribusi responden berdasarkan kategori tingkat pendidikan

Tabel 6. Distribusi responden berdasarkan kategori tingkat pendidikan

Pendidikan	Frekuensi	Persentase (%)
Tidak sekolah	1	0,3
Tidak tamat SD	6	2,0
Tamat SD	17	5,7
SLTP	29	5,8
SLTA	105	35,8
Akademi/PT	135	45,6
Lainnya	2	0,7

Dari tabel diatas terlihat responden yang tidak sekolah sebanyak 1 orang (0,3%), responden yang tidak tamat SD sebanyak 6 orang (2%), responden yang tamat SD sebanyak 17 orang (5,7%), responden dengan tingkat pendidikan SLTP sebanyak 29 orang (5,8%), responden dengan tingkat pendidikan SLTA sebanyak 105 orang (35,8%), responden dengan tingkat pendidikan Akademi/PT sebanyak 135 orang (45,6%), dan lainnya sebanyak 2 orang (0,7%).

4.1.1.6. Distribusi responden berdasarkan kategori pekerjaan

Tabel 7. Distribusi responden berdasarkan kategori pekerjaan

Kategori pekerjaan	Frekuensi	Persentase (%)
PNS/ABRI	115	38,9
Pegawai Swasta	15	5,1
Wiraswasta	38	12,8
Pensiunan	8	2,7
Buruh	3	1,0
Mocok-mocok	9	3,0
Tidak bekerja	108	36,5

Dari tabel diatas terlihat responden dengan kategori pekerjaan PNS/ABRI sebanyak 115 orang (38,9%), pegawai swasta sebanyak 15 orang (5,1%), wiraswasta sebanyak 38 orang (12,8%), pensiunan sebanyak 9 orang (3%), buruh sebanyak 3 orang (1%), mocok-mocok sebanyak 9 orang (3%), dan tidak bekerja sebanyak 108 orang (36,5%).

4.1.1.7. Distribusi responden berdasarkan penghasilan

Tabel 8. Distribusi responden berdasarkan penghasilan

Penghasilan	Frekuensi	Persentase (%)
< 3,3 juta	128	43,2
≥ 3,3 juta	168	56,8

Dari tabel diatas terlihat sebagian besar responden memiliki penghasilan ≥ 3,3 juta sebesar 168 orang (56,8%) dan yang memiliki penghasilan < 3,3 juta orang sebesar 128 orang (43,2%).

4.1.1.8. Distribusi responden berdasarkan riwayat diabetes dalam keluarga

Tabel 9. Distribusi responden berdasarkan riwayat diabetes dalam keluarga

Riwayat diabetes dalam keluarga	Frekuensi	Persentase (%)
Ada	99	43,2
Tidak ada	186	62,8
Tidak tahu	11	**3,7**

Dari tabel diatas terlihat sebagian besar responden tidak memiliki riwayat diabetes dalam keluarga sebesar 186 orang (62,8%), memiliki riwayat diabetes dalam keluarga sebesar 99 orang (43,2%) , dan yang tidak tahu sebesar 11 orang (3,7%).

4.1.1.9. Distribusi responden berdasarkan riwayat hipertensi dalam keluarga

Tabel 10. Distribusi responden berdasarkan riwayat hipertensi dalam keluarga

Riwayat hipertensi dalam keluarga	Frekuensi	Persentase (%)
Ada	107	36,1
Tidak ada	181	61,1
Tidak tahu	8	2,7

Dari tabel diatas terlihat sebagian besar responden tidak memiliki riwayat hipertensi dalam keluarga sebesar 181 orang (61,1%), memiliki riwayat hipertensi dalam keluarga sebesar 107 orang (36,1%) , dan yang tidak tahu sebesar 8 orang (2,7%).

4.1.1.10. Distribusi responden berdasarkan menderita diabetes mellitus

Tabel 11. Distribusi responden berdasarkan menderita diabetes mellitus

Menderita diabetes mellitus	Frekuensi	Persentase(%)
ya	148	50,0
Tidak	148	50,0

Dari tabel diatas terlihat sebagian besar responden tidak menderita diabetes sebesar 148 orang (50,0%), dan menderiyta diabetes sebesar 148 orang (50,0%)

4.1.1.11. Distribusi responden berdasarkan menderita hipertensi

Tabel 12. Distribusi responden berdasarkan menderita hipertensi

Menderita hipertensi	Frekuensi	Persentase(%)
ya	114	38,5
Tidak	182	61,5

Dari tabel diatas terlihat sebagian besar responden tidak menderita hipertensi sebesar 114 orang (38,5%), dan menderita hipertensi sebesar 182 orang (61,5%)

4.1.1.12. Distribusi responden berdasarkan faktor risiko klinis

Tabel 13. Distribusi responden berdasarkan faktor risiko klinis

Variabel	Minimun	Maksimum	Mean (SD)	SD
Berat badan	40,0	119,0	65,9	12,2
Tinggi badan	59,0	177,0	154,6	8,7

IMT responden	17,1	84,0	27,8	6,1
Lingkar perut	72,0	192,0	93,8	11,7
Tekanan darah sistolik	94,0	210,0	136,4	23,4
Tekanan darah diastolik	58,0	178,0	82,9	13,7
Kadar gula darah sewaktu	51,0	548,0	170,6	99,5
Kadar kolestrol darah	82,0	331,0	212,2	46,5

Dari tabel diatas terlihat nilai minimum berat badan 40,0 kg dan nilai maksimum berat badan sebesar 119kg dengan 65,9 ±12,2. Tinggi badan minimum 59,0 cm, tinggi badan maksimum 177cm dengan 154,6±8,7. IMT minimum 17,1 dan IMTmaksimum 84,0 dengan 27,8±6,1. Lingkar perut minimum 72,0 cm dan maksimum 192,0 cm dengan 93,8±11,7. Tekanan darah sistolik minimum 94,0 mmHg dan maksimum maksimum 210 mmHg dengan 136,4±23,4. Tekanan darah diastolik minimum 58,0 mmHg, maksimum 178,0 mmHg dengan 82,9±13,7. Kadar gula darah sewaktu minimum 51,0 mg/dl, maksimum 548, 0 mg/dl dengan 170,6±99,5. Kadar kolesterol darah sewaktu minimum 82,0 mg/dl dan maksimum 331 mg/dl dengan 212,2±46,5

4.1.1.13. Distribusi responden berdasarkan Body Mass Index

Tabel 14. Distribusi responden berdasarkan Body Mass Index

Kategori BMI	Frekuensi	Persentase (%)
Kurus	3	1
Normal	89	30,1
Gemuk	204	68,9

Dari tabel diatas terlihat mayoritas responden dengan kategori gemuk sebesar 204 orang (68,9%).normal sebesar 89 orang (30,1%) dan kurus sebanyak 3 orang (1 %).

4.1.1.14. Distribusi responden berdasarkan kategori lingkar perut

Tabel 15. Distribusi responden berdasarkan kategori lingkar perut

Lingkar perut	Frekuensi	Persentase (%)
Laki-laki		
Normal	18	29,5
Berisiko	43	70,5
Perempuan		
Normal	22	9,4
Berisiko	213	90,6

Dari tabel diatas terlihat responden laki-laki yang memiliki lingkar perut normal yaitu sebanyak 18 orang (29,5%), berisiko sebanyak 43 orang (70,5%), responden perempuan yang memiliki lingkar perut normal yaitu sebanyak 22 orang (9,4%) dan lingkar perut berisiko sebanyak 213 orang (90,6%).

4.1.1.15. Distribusi responden berdasarkan kategori tekanan darah

Tabel 16. Distribusi responden berdasarkan tekanan darah

Tekanan darah	Frekuensi	Persentase (%)
Tekanan darah sistolik		
Normal	82	27,7
Pre-hipertensi	97	32,8
Hipertensi	117	39,5
Tekanan darah diastolik		
Normal	142	48,0
Pre-hipertensi	83	28,0
Hipertensi	71	24,0

Dari tabel diatas terlihat sebagian besar responden memiliki tekanan darah sistolik kategori hipertensi sebesar 117 orang (39,5%), pre hipertensi sebesar 97 orang (32,8%) dan tekanan darah normal sebesar 82 orang (27,5%). Berdasarkan tekanan darah diastolik, sebagian besar memiliki tekanan darah normal sebesar 142 orang (48,0%), pre hipertensi sebesar 83 orang (28,0%) dan hipertensi sebesar 71 orang (24,0%).

4.1.1.16. Distribusi responden berdasarkan kategori kadar gula darah

Tabel 17. Distribusi responden berdasarkan kategori kadar gula darah

Kadar Gula darah	Frekuensi	Persentase (%)
Normal	213	72,0
Tinggi	83	28,0

Dari tabel sebagian besar responden memiliki kadar gula darah normal sebesar 213 orang (72%) dan kadar gula darah tinggi sebesar 83 orang (28%).

4.1.1.17. Distribusi responden berdasarkan kadar kolesterol

Tabel 18. Distribusi responden berdasarkan kadar kolesterol

Kadar kolesterol	Frekuensi	Persentase (%)
Normal	127	42,9
Tinggi	169	57,1

Dari tabel diatas terlihat sebagian responden memiliki kadar

kolesterol tinggi sebesar 169 orang (57,1%) dan kadar kolesterol normal sebesar 127 orang (42,9%).

.

4..1.1.18. Distribusi responden berdasarkan kategori jumlah karbohidrat

Tabel 19. Distribusi responden berdasarkan asupan karbohidrat rata- rata

	n	Minimum	Maksimum	Mean	SD
Jumlah Karbohidrat	296	29.4	887.7	127.093	96.4904

Dari tabel diatas terlihat bahwa proporsi responden berdasarkan kategori jumlah karbohidrat, sebanyak 296 orang , dengan nilai minimum sebesar 29.4, nilai maksimum sebesar 887.7, nilai rata-rata sebesar 127.093 dan standar deviasi 96.4904.

Tabel 20. Distribusi responden berdasarkan kategori asupan karbohidrat

Konsumsi karbohidrat	Frekuensi	Persentase (%)
Lebih	5	1.7
Cukup	18	6.1
Kurang	273	92.2

Dari tabel diatas terlihat responden dengan kategori konsumsi karbohidrat sebanyak 5 orang (1.7%), konsumsi karbohidrat cukup sebanyak 18 orang (6.1%), dan konsumsi karbohidrat kurang sebanyak 273 orang (92.2%).

4.1.1.19. Distribusi responden berdasarkan jumlah kalori

Table 21. Distribusi responden berdasarkan asupan kalori rata rata

	n	Minimum	Maksimum	Mean	SD
Jumlah Kalori	296	2.1	3003.5	1013.141	511.6083

Dari tabel diatas terlihat bahwa proporsi responden berdasarkan kategori jumlah kalori, sebanyak 296 orang , dengan nilai minimum sebesar 2.1, nilai maksimum sebesar 3003.5, nilai rata-rata sebesar 1013.141 dan standar deviasi 511.6083.

Table 22. Distribusi responden berdasarkan asupan kalori

Konsumsi kalori	Frekuensi	Persentase (%)
Lebih	10	3.4
Cukup	24	8.1
Kurang	262	88.5

Dari tabel diatas terlihat responden dengan kategori konsumsi kalori lebih

sebanyak 10 orang (3.4%), konsumsi kalori cukup sebanyak 24 orang (8.1%), dan konsumsi kalori kurang sebanyak 262 orang (88.5%).

4.1.1.20. Distribusi responden berdasarkan jumlah protein

Tabel 23. Distribusi responden berdasarkan asupan protein

	n	Minimum	Maksimum	Mean	**SD**
Jumlah Protein	296	3.2	173.4	44.500	20.0639

Dari tabel diatas terlihat bahwa proporsi responden berdasarkan kategori jumlah protein, sebanyak 296 orang , dengan nilai minimum sebesar 3.2, nilai maksimum sebesar 173.4, nilai rata-rata sebesar 44.500 dan standar deviasi 20.0639.

Tabel 24. Distribusi responden berdasarkan asupan protein

Konsumsi protein	Frekuensi	Persentase (%)
Lebih	32	10.8
Cukup	48	16.2
Kurang	216	73.0

Dari tabel diatas terlihat responden dengan kategori konsumsi protein lebih sebanyak 32 orang (10.8%), konsumsi protein cukup sebanyak 48 orang (16.2%), dan konsumsi protein kurang sebanyak 216 orang (73.0%).

4.1.1.21. Distribusi responden berdasarkan jumlah lemak

Tabel 25. Distribusi responden berdasarkan asupan lemak

	n	Minimum	Maksimum	Mean	SD
Jumlah Lemak	296	1.0	970.3	43.852	59.7025

Dari tabel terlihat proporsi responden berdasarkan kategori jumlah lemak, sebanyak 296 orang , dengan nilai minimum sebesar 1.0, nilai maksimum sebesar 970.3, nilai rata-rata sebesar 43.852dan standar deviasi 59.7025.

Tabel 26. Distribusi responden berdasarkan asupan lemak

Konsumsi lemak	Frekuensi	Persentase (%)
Lebih	28	9.5
Cukup	17	5.7
Kurang	251	84.8

Dari tabel diatas terlihat responden dengan kategori konsumsi lemak

lebih sebanyak 28 orang (9.5%), konsumsi lemak cukup sebanyak 17 orang (5.7%), dan konsumsi lemak kurang sebanyak 251 orang (84.8%).

4.1.1.22. Distribusi responden berdasarkan jumlah Natrium

Table 27. Distribusi responden berdasarkan asupan natrium

	n	Minimum	Maksimum	Mean	SD
Jumlah Natrium	296	10.6	1497.2	319.582	275.5913

Dari tabel diatas terlihat bahwa proporsi responden berdasarkan kategori jumlah natrium, sebanyak 296 orang , dengan nilai minimum sebesar 10.6, nilai maksimum sebesar 1497.2 , nilai rata-rata sebesar 319.582 dan standar deviasi 275.5913.

Table 28. Distribusi responden berdasarkan kategori asupan natrium

Kategori konsumsi natrium	Frekuensi	Persentase (%)
Baik	296	100.0
Tidak baik	0	0

Dari tabel diatas terlihat responden dengan kategori konsumsi natrium baik sebanyak 296 orang (100%) dan konsumsi natrium tidak baik sebanyak 0 orang (0%).

4.1.1.23. Distribusi responden berdasarkan kebiasaan merokok

Tabel 29. Distribusi responden berdasarkan kategori kebiasaan merokok

Kebiasaan merokok	Frekuensi	Persentase (%)
Ya	33	11,1
Tidak	263	88,9

Dari tabel diatas terlihat responden yang memiliki kebiasaan merokok sebanyak 33 orang (11,1%) dan yang tidak memiliki kebiasaan merokok sebanyak 263 orang (88,9%).

4.1.1.24. Distribusi responden berdasarkan kategori konsumsi alkohol

Tabel 30. Distribusi responden berdasarkan konsumsi alkohol

Konsumsi alkohol	Frekuensi	Persentase (%)
Ya	3	1
Tidak	293	99

Dari tabel terlihat responden yang mengonsumsi alkohol sebanyak 3 orang (1%), dan yang tidak mengonsumsi alkohol sebanyak 293 orang (99%).

4.1.1.25. Distribusi responden berdasarkan konsumsi buah dan sayur

Tabel 31. Distribusi responden berdasarkan konsumsi buah dan sayur

Konsumsi buah dan sayur	Frekuensi	Persentase (%)
Sayur		
Setiap Hari	234	79,1
Tidak Setiap Hari	62	20,9
Buah		
Setiap Hari	199	67.2
Tidak Setiap Hari	97	32.8

Dari tabel diatas terlihat responden yang mengonsumsi sayur setiap hari sebanyak 234 orang (79,1%), dan yang mengonsumsi sayur tidak setiap hari sebanyak 62 orang (20,9%). Kemudian responden yang mengonsumsi buah setiap hari sebanyak 199 orang (67.2%) dan yang tidak mengonsumsi sayur tidak setiap hari sebanyak 97 orang (32.8%).

4.1.1.26. Distribusi responden berdasarkan konsumsi makanan atau minuman manis

Tabel 32. Distribusi responden berdasarkan konsumsi makanan atau minuman manis

Konsumsi makanan atau minuman manis	Frekuensi	Persentase (%)
1-3 x/hari	103	34,8
1-4x/minggu	117	39,8
1-3x/bulan	63	21,3
Tidak pernah	13	3,4

Dari tabel diatas terlihat responden dengan kategori konsumsi makanan atau minuman manis 1-3 x/hari sebanyak 103 orang (34,8%), 1-4 x /minggu sebanyak 117 orang (39,8%), 1-3x/bulan sebanyak 63 orang (21,3%), dan tidak pernah sebanyak 13 orang (3,4%).

4.2. Analisis Bivariat

Tabel 33**.** Faktor – Faktor yang berhubungan dengan kejadian diabetes melitus dengan *Simple Logistic Regression.*

Variabel	DM	Non DM	p	RP (95% CI)
Faktor individu				
Umur				
<= 50 tahun	39(32,2%)	82(67,8%)	0,000	3,47(2,13-5,66)
>50 tahun	109(62,3%)	66(37,7%)		
Jenis kelamin				
Laki laki	45(76,3%)	14(23,7%)	0,000	4,18(2,18-8,03)
Perempuan	103(43,5%)	133(56,5%)		
Pendidikan				
Rendah	40(75,5%)	13(24,5%)	0,000	3,85(1,76-7,55)
Tinggi	108(44,4%)	135(55,6%)		
Penghasilan				
≤3,3 juta	83(64,8%)	45 (35,2%)	0,000	2,92(1,81-4,71)
>3,3 juta	65 (38,7%)	103(61,3%)		
IMT	23(53,5%)	20 (46,5%)	0,698	1,14(0,59-2,20)
Normal	125(49,4%)	128(50,5%)		
Berisiko				
Lingkar Perut	29(56,9%)	22(43,1%)	0,283	0,72(0,39-1,39)
Tak berisiko	119(48,6%)	126(51,4%)		
Berisiko				
Riwayat DM	86(43,1%)	111(56,3%)	0,002	2,16(1,32-3,54)
Tidak/tidak tahu	62(62,6%)	37(37,4%)		
Ya				
TD Sistolik	17(20,7%)	65(79,3%)	0,000	6,04(3,31-11,00)
Normal	131(61,2%)	83(38,8%)		
Tinggi				
Kebiasaan merokok	25(75,8%)	8(24,2%)	0,003	3,55(1,55-8,18)
Ya	123(46,8%)	140(53,2%)		
Tidak				
Aktifitas Fisik				
Sedang/berat	82(43,6%)	106(56,4%)	0,004	2,02(1,26-3,29)
Ringan	66(61,1%)	42(38,9%)		

Konsumsi sayur buah Tidak setiap hari Setiap hari	 39(62,9%) 109(45,6%)	 23(37,1%) 125(53,4%)	 0,024	 1,95(1,09-3,45)
Faktor Lingkungan Kepadatan hunian Tidak memenuhi syarat Memenuhi syarat Fasilitas Olah raga Tidak ada Ada Pendidikan Kepala RT Rendah Tinggi	 45(60,8%) 103(46,4%) 122(52,8%) 26(40,0%) 32(71,1%) 116(46,7%)	 29(39,2%) 119(53,6%) 109(47,2%) 26(40,0%) 13(28,9%) 135(53,8%)	 0,033 0,069 0,003	 1,71(1,05-2,06) 1,68(0,96-2,94) 2,87(1,44-5,72)

Dari analisis dengan *Simple logistic regression* terdapat 9 variabel individu dan 3 variabel lingkungan yang signifikan dan memiliki p < 0.25 , sehingga dimasukkan dalam model multivariate. Variabel individu yang signifikan meliputi umur, jenis kelamin, pendidikan, penghasilan, memiliki asuransi kesehatan, memiliki riwayat diabetes dalam keluarga, memiliki TD sistolik yang tinggi, mempunyai kebiasaan merokok, kurang aktifitas fisik, dan kebiasaan mengkonsumsi sayur dan buah. Variabel lingkugan yang signifikan meliputi kepadatan hunian, tidak adanya fasilitas olahraga dan tingkat pendidikan kepala RT.

4.3. Analisis Multivariat

Tabel 34. Faktor yang berhubungan dengan kepatuhan pengobatan hipertensi dengan ***uji Multiple Logistic Regression***

Variabel	p	RP (95%CI)
Umur	0.000	3.79(2,04;7,02)
Penghasilan keluarga	0.012	2.20 (1.18;4.08)
Riwayat Keluarga menderita DM	0.000	5.84(2.89;11.79)
Tekanan darah sistolik tinggi	0.000	6.51(3.21;13.21)
Kebiasaan merokok	0.004	4.31(1.59 ; 11.62)
Tingkat Pendidikan Kepala RT	0.002	1.76(1.24 ; 2.53)

Dari analisis dengan Multiple logistic regression dengan method forward LR, diperoleh variabel yang signifikan adalah umur, penghasilan keluarga, riwayat keluarga menderita diabetes, tekanan darah sistolik tinggi, kebiasaan merokok, dan tingkat pendidikan kepala rumah tangga. Proporsi umur > 50 tahun menderita diabetes 3,79 kali lebih besar dibanding umur < 50 tahun (RP 3.79(2.04;7.02). Proporsi orang dengan penghasilan < 3.3 juta menderita diabetes 2.20 kali lebih besar dibanding yang berpenghasilan >3.3 juta (RP 2.20 (1.18;4.08). Proporsi orang dengan riwayat diabetes dalam keluarga yang menderita diabetes 5.84 kali lebih besar dibanding yang tidak memiliki riawayat diabetes dalam keluarga (RP 5.84(2.89;11.79). Proporsi orang dengan sistolik tinggi menderita diabetes 6.51 kali lebih besar dibanding yang memiliki tekanan darah sistolik normal(RP6.51(3.21;13.21). Proporsi orang yang memiliki kebiasaan merokok menderita diabetes mellitus 4.31 kali lebih besar dibanding yang tidak merokok (RP 4.31(1.59;11.62). Proporsi keluarga dengan pendidikan kepala RT rendah menderita diabetes 1.76 kali lebih besar dibanding pendidikan kepala RT tinggi (RP 1.76(1.24;2.53). Persamaan model Prediksi kejadian diabetes adalah Y=1,312 +1,331umur+ 0,790 penghasilan keluarga + 1.764 riwayat menderita DM+1.784 menderita TD sistolik tinggi +1.460 kebiasaan merokok+ 0.571 pendidikan kepala RT.

4.4. Analisis Multilevel

a. Model Null

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Residual		.125424	.020654	6.072	.000	.090825	.173202
Intercept [subject = RT_kat]	Variance	.125424[b]	.000000	.	.	.	.

a. Dependent Variable: Kategori Responden.

b. This covariance parameter is redundant. The test statistic and confidence interval cannot be computed.

Dari tabel diatas diperoleh *intraclass correlation* (ICC) : 0.125424/ 0,250848 = 0.5 . Hasil ini menunjukkan bahwa 50,0% variasi dalam kejadian diabetes mellitus ditentukan oleh karakteristik rumah tangga

b. Model level 1

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1.044429	.079032	289	13.215	.000	.888878	1.199980
[Umur_kat=0]	-.223379	.053379	289	-4.185	.000	-.328440	-.118318
[Umur_kat=1]	0[b]	0	.	.	.	.	.
[Klg_DMkat=0]	-.262981	.053250	289	-4.939	.000	-.367788	-.158175
[Klg_DMkat=1]	0[b]	0	.	.	.	.	.
[TDS_kat=0]	-.313777	.058034	289.000	-5.407	.000	-.428000	-.199554
[TDS_kat=1]	0[b]	0	.	.	.	.	.
[Rokok=1]	.240408	.078940	289	3.045	.003	.085038	.395778
[Rokok=2]	0[b]	0	.	.	.	.	.
[PendidikanKRT_kat=0]	-.164460	.071129	289	-2.312	.021	-.304457	-.024463
[PendidikanKRT_kat=1]	0[b]	0	.	.	.	.	.
Penghasilan	-1.684548E-8	7.077945E-9	289	-2.380	.018	-3.077634E-8	-2.914628E-9

a. Dependent Variable: Kategori Responden.

b.. This parameter is set to zero because it is redundant.

Dari tabel diatas terlihat koefisien intercept sebesar 1.044429 setelah disesuaikan dengan prediktor umur, riwayat keluarga menderita diabetes, tekanan darah sistolik tinggi, merokok, penghasilan dan pendidikan kepala RT. Variabel umur, riwayat keluarga, penghasilan, tekanan darah sistolik tinggi, kebiasaan merokok dan pendidikan kepala RT berkontribusi pada kejadian diabetes mellitus

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Residual		.060471	.015092	4.007	.000	.037078	.098623
Intercept [subject = RT_kat]	Variance	.060471[b]	.000000	.	.	.	.
Umur_kat [subject = RT_kat]	Variance	.060471[b]	.000000	.	.	.	.

a. Dependent Variable: Kategori Responden.

b. This covariance parameter is redundant. The test statistic and confidence interval cannot be computed.

Dari tabel diatas terlihat ada penurunan variance estimate dibanding model null sebesar 0,064953/0.125424x 100 % = 51,7% yang berarti umur, riwayat diabetes dalam keluarga, penghasilan, menderita tekanan darah sistolik tinggi, kebiasaan merokok dan pendidikan Kepala RT memberi kontribusi sebesar 51,7% pada variabilitas kejadian diabetes mellitus

4.5. Pembahasan

Dari hasil penelitian diperoleh responden berumur minimum 33 tahun dan maksimum 60 tahun dengan mean ±SD : 51,67± 6,22. Sebagian besar responden berumur dalam rentang 46-60 tahun sebesar 234 orang (79,1%). Sebagian besar responden berjenis kelamin perempuan sebesar 237 orang (80,1%), status kawin 254 orang (85,8%), suku batak 149 orang (50,3%), pendidikan akademi/PT(45,6%) dengan penghasilan >3,3 juta sebesar 168 orang (56,8%).

Berdasarkan riwayat penyakit, 43,2% memiliki riwayat diabetes dalam keluarga, sebesar 107 orang (36,1%) memiliki riwayat hipertensi dalam keluarga dan 114 orang 38,5%) menderita hipertensi. Berdasarkan faktor risiko klinis sebanyak 204 orang (68,9%) memilki IMT kategori obesitas dan sekitar 70,5% memiliki lingkat perut berisiko. Sebesar 39,5% dengan hipertensi sistolik, dan 57,1% dengan kadar kolesterol tinggi.

Berdasarkan pola makan sebagian besar mengkonsumsi karbohidrat, kalori,protein dan lemak dalam jumlah yang kurang dengan persentase masing masing sebesar 99,2%, 88,5%, 73,0%, 84,8%. Berdasarkan perilaku berisiko hanya 33 orang (11,1%) orang yang memiliki kebiasaan merokok, sebanyak 3 orang (1%) mengkonsumsi alkohol, mengkonsumsi makanan manis 1-4 x /minggu sebanyak 117 orang (39,8%), 79,1 % mengkonsumsi sayur setiap hari dan 67,2% mengkonsumsi buah setiap hari.

Dari analisis dengan Multiple logistic regression diperoleh variabel yang signifikan adalah umur, penghasilan keluarga, riwayat keluarga menderita diabetes, tekanan darah sistolik tinggi, kebiasaan merokok, dan tingkat pendidikan kepala rumah tangga.

American Diabetes Association (ADA) (2011) menyatakan bahwa risiko diabetes mellitus tipe 2 meningkat seiring dengan bertambahnya usia. Mekanisme yang mendasari lebih tingginya risiko diabetes mellitus tipe 2 pada individu yang berusia lebih tua adalah

adanya peningkatan komposisi lemak dalam tubuh yang terakumulasi di abdomen, sehingga memicu terjadinya obesitas sentral. Obesitas sentral selanjutnya memicu terjadinya resistensi insulin yang merupakan proses awal diabetes mellitus tipe 2 (Suastika et al, 2012)

Riwayat keluarga merupakan salah satu faktor yang tidak dapat dihindari. Apabila salah satu dari orang tua menderita Diabetes Mellitus Tipe II, risiko anak untuk menderita Diabetes Mellitus Tipe II lebih besar dibandingkan dengan anak yang tidak memiliki riwayat keluarga Diabetes Mellitus Tipe II. Diabetes dapat terjadi karena adanya interaksi yang kompleks antara kecenderungan genetik dan perilaku hidup seseorang yang kurang sehat, sehingga memperkuat timbulnya penyakit Diabetes Mellitus. Hal ini terbukti dengan beberapa penelitian sebelumnya yang telah membuktikan bahwa orang yang memiliki riwayat keluarga menderita Diabetes Melitus dominan diturunkan atau diwariskan . Risiko menderita diabetes dari ibu lebih besar 10-30% diandingkan dari ayah.

Diabetes dan hipertensi sering terjadi bersamaan. Hiperglikemia sering disertai dengan sindrom metabolik, termasuk hipertensi, yang memicu dan memperburuk komplikasi kardiovaskular (Cheung dan Li, 2012). Di Amerika Serikat, hipertensi terjadi sekitar 50-80% pasien diabetes tipe 2 (Landsberg dan Molitch, 2004). Pada penelitian ini, tekanan darah sistolik yang tinggi berkontribusi terhadap kejadian diabetes melitus tipe 2. Temuan ini serupa dengan penelitian di Amerika Serikat, yang menemukan bahwa diabetes melitus tipe 2 2,5 kali lebih umum di antara subjek dengan hipertensi dibandingkan dengan subjek dengan tekanan darah normal (Gress et al, 2000).

BAB 6

KESIMPULAN DAN SARAN

Beberapa kesimpulan yang dapat disajikan

1. Berdasarkan sosiodemografi, mayoritas responden berumur 46-60 tahun sebesar 234 orang (70,1%). perempuan (80,1%), status kawin 254 orang (85,8%), suku batak 149 orang (50,3%), pendidikan akademi/PT(45,6%) dengan penghasilan >3,3 juta sebesar 168 orang (56,8%).
2. Berdasarkan riwayat penyakit ; 186 orang responden (62,8%) sebesar 99 orang (43,2%) memiliki riwayat diabetes dalam keluarga, 107 orang (36,1%) memiliki riwayat hipertensi dalam keluarga, dan 114 orang (38,5%) menderita hipertensi.
3. Berdasarkan faktor risiko klinis; sebanyak 204 orang (68,9%) memilki IMT kategori obesitas dan sekitar 70,5%- 90,6% memiliki lingkat perut yang berisiko terhadap terjadinya diabetes, sebesar 204 orang responden (68,9%) dengan hipertensi sistolik, dan sebesar 204 orang (68,9%) dengan kadar kolesterol tinggi.
4. Dari analisis dengan Multiple logistic regression dengan method forward LR, diperoleh variabel yang signifikan meliputi umur, penghasilan keluarga, riwayat keluarga menderita diabetes, tekanan darah sistolik tinggi, kebiasaan merokok, dan tingkat pendidikan kepala rumah tangga berkontribusi pada kejadian diabetes mellitus.
5. Dari analisis multilevel didapat 50,0% variasi dalam kejadian diabetes mellitus ditentukan oleh karakteristik rumah tangga.
6. Variabel umur, riwayat diabetes dalam keluarga, penghasilan, menderita tekanan darah sistolik tinggi, kebiasaan merokok dan pendidikan Kepala RT memberi kontribusi sebesar 51,7% pada variabilitas kejadian diabetes mellitus

Saran:

1. Meningkatkan edukasi pencegahan diabetes mellitus melalui penerapan pola hidup sehat antara lain tidak merokok
2. Melakukan pemeriksaan kesehatan secara teratur untuk deteksi dini faktor risiko metabolic seperti tekanan darah tinggi

DAFTAR PUSTAKA

1. Auchincloss AH, Mujahid MS, Shen M, Michos ED, Whitt-Glover MC, Diez Roux AV. Neighborhood health-promoting resources and obesity risk (the multi-ethnic study of atherosclerosis). Obesity 2013; 21(3): 621-8. https://doi.org/10.1002/oby.20255.

2. Astell-Burt T, Feng X, Kolt G. Is neighborhood green space associated with a lower risk of Type 2 diabetes? Australians. Diabetes Care [Internet]. 2014 [accessed on December 7, 2019]; 37(1): 197-201. Available at: https://doi.org/10.2337/dc13-1325 15.

3. den Braver NR, Lakerveld J, Rutters F, Schoonmade LJ, Brug J, Beulens JWJ. Built environmental characteristics and diabetes: a systematic review and meta-analysis. BMC Med 2018; 16(1): 12. https://doi.org/10.1186/ s12916-017-0997-z 16.

4. Budiarti E, Tamtomo DG, Adriani RB. 2016. Path analysis on the bio-psychosocial determinants of type 2 diabetes mellitus and depression at dr. Moewardi Hospital, Surakarta. J Epidemiol Public Healt. 3(1): 1–14. https://doi.org/10.2- 6911/jepublichealth.2018.03.01.01

5. Bravo MA, Anthopolos R, Kimbro RT, Miranda ML. Residential Racial Isolation and Spatial Patterning of Type 2 Diabetes Mellitus in Durham, North Carolina. Am J Epidemiol 2018; 187(7): 1467-76. https://doi. org/10.1093/aje/kwy026.

6. Cichosz SL, Johansen MD, Hejlesen O. Toward big data analytics: Review of predictive models in management of diabetes and its complications. J Diabetes Sci Technol 2015; 10(1): 27-34. https://doi. org/10.1177/1932296815611680.

7. Caballero AE. 2018. The " A to Z " of managing type 2 diabetes in culturally diverse populations. Frontiers in Endocrinology. 9(479): 1-15. Diakses dari https://www.frontiersin.org/articles-/10.3389/fendo.2018.00474/full.

8. Christine PJ, Auchincloss AH, Bertoni AG, Carnethon MR, Sánchez BN, Moore K, et al. Longitudinal Associations Between Neighborhood Physical and Social Environments and Incident Type 2 Diabetes Mellitus: The Multi-Ethnic Study of Atherosclerosis (MESA). JAMA Intern Med 2015; 175(8): 1311-20. https://doi.org/10.1001/jamainternmed.2015.2691 .

9. Chien, K., Cai, T., Hsu, H., Su, T., Chang, W., Chen, M., ... & Hu, F. B. 2009. A prediction model for type 2 diabetes risk among Chinese people. *Diabetologia*, *52*(3), 443-450.

10. Cheung BM, Li C. Diabetes and hypertension: is there a common metabolic pathway? Curr Atheroscler Rep 2012; 14:160-6.

11. Dinas Kesehatan Propinsi Sumatera Utara. 2020. Profil Kesehatan Propinsi Sumatera utara

12. Dinas Kesehatan Propinsi Sumatera Utara. 2021. Profil Kesehatan Propinsi Sumatera utara.

13. Dinas Kesehatan Kota Medan . 2021. Profil Kesehatan Kota Medan

14. Faka A, Chalkias C, Montano D, Georgousopoulou EN, Tripitsidis A, Koloverou E, et al. Association of Socio-Environmental Determinants with Diabetes Prevalence in the Athens Metropolitan Area, Greece: A Spatial Analysis. Rev Diabet Stud [Internet]. 2017 [accessed on December 9, 2019]; 14(4): 381-9. Available at: https://doi.org/10.1900/RDS.2017.14.381

15. Haynes-Maslow L, Leone LA. Examining the relationship between the food environment and adult diabetes prevalence by county economic and racial composition: an ecological study. BMC Public Health 2017; 17: 648. https://doi.org/10.1186/ s12889-017-4658-0.

16. International Diabetes Federation. 2020. IDF Diabetes Atlas ninth edition.

17. International Diabetes Federation. 2021. IDF Diabetes Atlas tenth edition.

18.Kementrian Kesehatan RI. 2020. Infodatin: Situasi dan Analisis Diabetes. Jakarta

19.KementrianKesehatan RI. 2018. Riset Keseahatan dasar. Badan Penelitian dan pengembangan kesehatan. Kementrian Kesehatan RI, Jakarta.

20.Kementrian Kesehatan RI. 2018. Pedoman umum pencegahan dan pengendalian diabetes tipe 2. Direktorat Jenderal Pencegahan dan Pengendalian Penyakit Tidak Menular.

21.Landsberg L, Molitch M. Diabetes and hypertension: pathogenesis, prevention and treatment. Clin Exp Hypertens 2004; 26: 621-8.

22.Murad MA, Samia S, Abdulmageed, Iftikhar R, Sagga BK (2014) Assessment of the common risk factors associated with type 2 diabetes mellitus in Jeddah. J Endocrinol 5(9): 1-9. http:-//doi.org- /10.1155/2014/616145

23. Perkumpulan Endokrinologi Indonesia. Konsensus Pengelolaan Dan Pencegahan Diabetes Melitus Tipe 2 Di Indonesia. 2015. Jakarta: PB Perkeni

24.Tjekyan RMS. 2014. Angka kejadian dan faktor risiko diabetes melitus tipe 2 di 78 RT Kotamadya Palembang tahun 2010 (Incidence and risk factors for type 2 diabetes mellitus in 78 RT in Municipality of Palembang in 2010). MKS. 46(2): 85–94. Retrieved from https://ejournal.unsri.ac.id/ind-ex.- php/mks/article/view/2688/pdf.

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Chairperson

Identifiifying people at risk of Diabetes Mellitus Residing in Medan City, Indonesia: A Cross Sectional study

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Objectives : This study aimed to determine diabetes mellitus risk among adult population in Medan City.
Methods : This study was an observational study with Cross sectional design. This study was conducted among 148 people with diabetes mellitus and 148 people without diabetes mellitus from 6 subdistrict in Medan City. Data was collected using a self-administered questionnaire and made measurement. Data were analyzed using simple and multiple logistic regression.
Results: The majority of respondents (234) were aged 46-60 years old (79,1%), 237 were female (80,17%), 240 had higher education (81,4%), 213 were overweight (71.0%), 186 had no family history with diabetes (62,8%), 107 had hypertension history (36.1%). 168 (56,8%)with income more than 3.3 million, 204 with overweight (68,9%), 234 with vegetables consumption (79.1%), 199 (672%)with fruit consumption, Of Multiple logistic regression found Age , Overweight, history of hypertension and family history of diabetes were significant with the risk category of diabetes.
Conclusions: Age, overweight, family history of diabetes, history with hypertension were contributing factor for diabetes mellitus.

Keywords: Diabetes risk, indentify, determinant

INTRODUCTION

Diabetes mellitus is currently a serious global health problem in the world and has an impact on the quality of human resources so it needs serious attention [1]. According to WHO data (2016), the prevalence of Diabetes mellitus is increasing [2], there are 425 million people suffering from Diabetes in the world in 2017 and it is predicted that the number of people suffering from Diabetes mellitus will increase to 629 million by 2045 [3]. The results of Riskesdas (2018) in Indonesia have increased the prevalence of diabetes mellitus from 6.9% (2013) to 8.5% (2018) [4]. Indonesia has the 7th highest prevalence of Diabetes mellitus in the world after China, India, USA, Brazil, Russia and Mexico [1] and it is predicted that in 2030 it will be in the fourth position with the highest prevalence of diabetes with a prevalence of 21.3 million people [5].

North Sumatra ranks 13th in the highest prevalence of diabetes mellitus in Indonesia with a prevalence of 2.3% [6]. In Medan City, in 2017 there were 34,874 cases of diabetes mellitus [7]. The occurrence of diabetes mellitus is not only influenced by individual factors but also by environmental factors. The prevalence of diabetes is still quite high, so effective prevention is necessary. One way is to develop prospective health services, which focus on preventing the development of a disease by conducting an individual risk assessment. The high success rate of early intervention in preventing the development of Type 2 diabetes in individuals makes disease risk assessment an important part of the prevention process. Thus this research needs to be carried out to assess the risk of healthy individuals suffering from type 2 diabetes within 10 years and identify risk factors.

Subjects and Methods

This study was Case control study. The recruited sample included 296 people consisted of 148 people with diabetes mellitus and 148 people without diabetes mellitus that was selected from seven health facilities in the Medan City from July to Desember 2022.

Data were collected with interviews using structured questionnaires involving sociodemographic, risk behavior and made measurements involving weight, height, blood pressure, and blood sugar. Blood pressure was measured twice using a sphygmomanometer with 5-minute intervals. Hypertension was defined as an average systolic blood pressure of 140 mmHg or more. Height was measured using a Microtoise GEA stadiometer, and body weight was evaluated using a digital scale to determine body mass index. Individuals with a BMI $\geq$ 25.1 kg/m^2 were defined as overweight, those with a BMI with a BMI< 25/m^2 were considered normal weight. Blood sugar was measured at fasting glucose blood with capillary blood glucose meter Accu Check . Diabetes risk was categorized by normal was defined as blood sugar < 100 mg/dl, prediabetes was defined as blood sugar 100-125 mg/dl and diabetes as defined blood glucose 126 mg/dl or more.

The structured questionnaire included information about sociodemographic (sex, age, education level, occupation, income), Clinical factors (family history of diabetes, history of hypertension, history with high blood pressure, nutritional status) and risk behavior (fruit and vegetables consumption)

Data were analyzed using the Statistical Package for Social Science (Release 24.0 program, SPSS, Inc., Chicago, Illinois, USA). The results of the descriptive analysis of the variables are presented either as frequency distributions or proportions. The association of risk factors with diabetes mellitus was analyzed using simple logistic regressions. Furthermore, multiple logistic regression was performed to determine factors contributing on diabetes mellitus

ETHICAL CONSIDERATION

This study was carried out with approval of the Research and Ethics Committee, Universitas Prima Indonesia, (Reference code number 002/KEP/UNPRI/X/2022).

RESULTS

The majority of respondents (234) were aged 46-60 years old (79,1%), 237 were female (80,17%), 243 had higher education (81,4%), 213 were overweight (71.0%), 186 had no family history with diabetes (62,8%), 107 had hypertension history (36.1%). 168 with income more than 3.3 million, 204 with overweight (68,9%), 234 with vegetables consumption (79.1%), 199 (67,2%) with fruit consumption.

From bivariate analysis (Table1) we find that age, income , family history with diabetes, family history with hypertension, overweight, vegetable consumption had p <0.25, it means these variables was significant and then entered in multivariate model

Table1. Factors associated with diabetes mellitus using Simple logistic regression

Variable	p	RP (95%CI)
Age	0.000	3,47(2,13;5,66)
Income	0.203	1.55 (0.79;3.02)
Education	0.271	1.45 (0.75;2.81)
Family history with diabetes	0.007	4.61(1.52;14.28)
Family history with hypertension	0.003	2.66(1.38;5.12)
Overweight	0.045	2.05(1.02;4.15)

Vegetable consumption	0.240	0.95 (0.51;1.74))
Fruit consumption	0.826	0.93(0.50;1.76)

Table2. Factors associated with diabetes mellitus using ***Multiple Logistic regression***

Variabel	p	RP (95%CI)
Age	0.000	3.79(2,04;7,02)
Family history with diabetes	0.000	5.84(2.89;11.79)
Family history with hypertension	0.000	6.51(3.21;13.21)
Overweight	0.004	4.31(1.59 ; 11.62)

Discussion

From the results of the study, it was found that the respondents were at least 33 years old and 60 years at the maximum with a mean ± SD: 51.67 ± 6.22. Most of the respondents were in the range of 46-60 years, amounting to 234 people (79.1%). Most of the respondents were female, 237 people (80.1%), marital status 254 people (85.8%), Batak ethnicity 149 people (50.3%), college education/PT (45.6%) with income >3.3 million, 168 people (56.8%).

The American Diabetes Association (ADA) (2011) states that the risk of type 2 diabetes mellitus increases with age. The mechanism underlying the higher risk of type 2 diabetes mellitus in older individuals is an increase in the composition of body fat that accumulates in the abdomen, thus triggering central obesity. Central obesity then triggers insulin resistance which is the initial process of type 2 diabetes mellitus.

Family history is one factor that cannot be avoided. If one of the parents suffers from Type II Diabetes Mellitus, the risk of the child suffering from Type II Diabetes Mellitus is greater than that of children who do not have a family history of Type II Diabetes Mellitus. Diabetes can occur due to a complex interaction between genetic predisposition and unhealthy behavior of a person, thereby strengthening the emergence of Diabetes Mellitus. This is proven by several previous studies which have proven that people who have a family history of suffering from Diabetes Mellitus are dominantly inherited or inherited. The risk of suffering from diabetes from the mother is 10-30% greater than that of the father.

Diabetes and hypertension often occur together. Hyperglycemia is often accompanied by metabolic syndrome, including hypertension, which triggers and exacerbates cardiovascular complications (Cheung and Li, 2012). In the United States, hypertension occurs in approximately 50-80% of patients with type 2 diabetes (Landsberg and Molitch, 2004). In this study, high systolic blood pressure contributes to the incidence of type 2 diabetes mellitus. This finding is similar to a study in the United States, which found that type 2 diabetes mellitus was 2.5 times more common among subjects with hypertension than subjects with low blood pressure. normal (Gress et al, 2000)

In summary, this study showed that age, overweight, family history with diabetes and family history with hypertension contributed to the risk of type 2 diabetes mellitus. These findings are useful and can be incorporated into prevention interventions

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References

1. Auchincloss AH, Mujahid MS, Shen M, Michos ED, Whitt-Glover MC, Diez Roux AV. Neighborhood health-promoting resources and obesity risk (the multi-ethnic study of atherosclerosis). Obesity 2013; 21(3): 621-8. https://doi.org/10.1002/oby.20255.

2. Astell-Burt T, Feng X, Kolt G. Is neighborhood green space associated with a lower risk of Type 2 diabetes? Australians. Diabetes Care [Internet]. 2014 [accessed on December 7, 2019]; 37(1): 197-201. Available at: https://doi.org/10.2337/dc13-1325 15.

3. den Braver NR, Lakerveld J, Rutters F, Schoonmade LJ, Brug J, Beulens JWJ. Built environmental characteristics and diabetes: a systematic review and meta-analysis. BMC Med 2018; 16(1): 12. https://doi.org/10.1186/ s12916-017-0997-z 16.

4. Budiarti E, Tamtomo DG, Adriani RB. 2016. Path analysis on the bio-psychosocial determinants of type 2 diabetes mellitus and depression at dr. Moewardi Hospital, Surakarta. J Epidemiol Public Healt. 3(1): 1–14. https://doi.org/10.2- 6911/jepublichealth.2018.03.01.01

5. Bravo MA, Anthopolos R, Kimbro RT, Miranda ML. Residential Racial Isolation and Spatial Patterning of Type 2 Diabetes Mellitus in Durham, North Carolina. Am J Epidemiol 2018; 187(7): 1467-76. https://doi. org/10.1093/aje/kwy026.

6. Chien, K., Cai, T., Hsu, H., Su, T., Chang, W., Chen, M., ... & Hu, F. B. 2009. A prediction model for type 2 diabetes risk among Chinese people. *Diabetologia*, *52*(3), 443-450.

7. Cheung BM, Li C. Diabetes and hypertension: is there a common metabolic pathway? Curr Atheroscler Rep 2012; 14:160-6.

8. .Landsberg L, Molitch M. Diabetes and hypertension: pathogenesis, prevention and treatment. Clin Exp Hypertens 2004; 26: 621-8.

SKEMA PENELITIAN KOLABORASI INTERNASIONAL

MODEL PREDIKSI RISIKO KERENTANAN SOSIAL TERHADAP KEJADIAN DIABETES MELLITUS TYPE 2; ANALISIS MULTILEVEL.

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ABSTRAK

Diabetes mellitus adalah masalah kesehatan global. Data IDF menunjukkan 537 juta pada tahun 2021. Diprediksi jumlah penderita diabetes meningkat menjadi 643 juta pada 2030 dan 783 juta pada tahun 2045. Di Indonesia pada tahun 2021, diabetes menempati urutan kelima dengan prevalensi 10,6%. Propinsi Sumatera Utara diabetes menduduki urutan ke 13 tertinggi di Indonesia dengan prevalensi sebesar 2,3%. Di Kota Medan tahun 2021 jumlah penderita diabetes mellitus sebesar 39843 penderita. Faktor karakteristik individu, sosial, gaya hidup, dan lingkungan berkontribusi pada kejadian diabetes. Penelitian bertujuan menentukan model prediksi risiko kerentanan sosial terhadap terjadinya Diabetes mellitus type 2. Penelitian bersifat observational dengan disain *cross sectional* dilakukan dalam Agustus-Desember 2022. Data dianalisis dengan uji *multilevel regresi logistic.* Dari hasil penelitian diperoleh mayoritas responden berumur 46-60 tahun sebesar 79,1%. perempuan sebesar 80,1%, suku batak sebesar 50,3%, penghasilan >3,3 juta sebesar 56,8%. memiliki riwayat diabetes dalam keluarga sebesar 43,2%, riwayat hipertensi dalam keluarga sebesar 36,1%, dan 38,5% menderita hipertensi. Sebesar 68,9% memilki IMT kategori obesitas, Sebesar 70,5% lingkat perut yang berisiko 68,9%, hipertensi sistolik sebesar 68,9%, dan kadar kolesterol tinggi sebesar 57,1%. Hasil uji regresi logistic multivariate diperoleh umur, jumlah penghasilan, riwayat keluarga menderita diabetes mellitus, riwayat menderita tekanan darah sistolik tinggi , kebiasan merokok dan tingkat pendidikan kepala rumah tangga berkontribusi terhadap kejadian diabetes mellitus dengan persamaan model prediksi Y=1,312 +1,331umur+ 0,790 penghasilan keluarga + 1.764 riwayat menderita DM+1.784 menderita TD sistolik tinggi +1.460 kebiasaan merokok+ 0.571 pendidikan kepala RT. Dari analisis multilevel regresi didapat 50,0% variasi dalam kejadian diabetes mellitus ditentukan oleh karakteristik rumah tangga dan variabel umur, riwayat diabetes dalam keluarga, penghasilan, menderita tekanan darah sistolik tinggi, kebiasaan merokok dan pendidikan Kepala RT memberi kontribusi sebesar 51,7% pada variabilitas kejadian diabetes mellitus

Kata kunci: Diabetes mellitus, kerentanan sosial, prediksi, multilevel.