DAFTAR PUSTAKA

Adhikari, R., & Agrawal, R. K. (2013). *An Introductory Study on Time Series Modeling and Forecasting*.

Adi. (2023). *Personal Interview*.

Alfarezi. (2013). *Analisis Perbandingan Metode Exponential Smoothing dan Moving Average Untuk Meramal Penjualan Barang CV. Amanah Riau*.

Ardiansah, I., Pujianto, T., & Putri, G. A. (2017). Analisis perencanaan dan pengendalian persediaan beras pada perum bulog divisi regional jawa barat. In *Jurnal String* (Vol. 2, Issue 1).

Ardinata, Muh. F. (2023). *Personal interview*.

Atmosudirjo, P. (1979). *Administrasi dan Manajemen Umum*. PT Gahlia Indonesia.

Azizah. (2020). *Perbandingan Metode Holt Winter's Exponential Smoothing dan Extreme Learning Machine Pada Peramalan Jumlah Penumpang Kereta Api*.

Cahyani, R. D. (2018). *Peramalan Permintaan Golongan Darah A, B, O Dan AB Dengan Metode Exponential Smoothing Dan Metode Dekomposisi Di UTD PMI Kota Malang*.

Dwiputranti, M. I., & Gandara, N. U. (2021). Penerapan model silver meal heuristik untuk optimalisasi persediaan beras di bulog sub divre ciamis. *Jurnal Logistik Bisnis*, *11*(02).

Febriana, E. T. (2018). *Fuzzy Time Series Chen Orde Tinggi untuk Meramalkan Jumlah Penumpang dan Kendaraan Kapal (Studi Kasus: PT ASDP Indonesia Ferry (Persero) Cabang Merak)*.

Fitriawan, M. C. (2023). *Personal Interview*.

Google Inc. (2023). *Google Maps: Peta Lokasi BULOG Subdivre Makassar*. https://goo.gl/maps/pCmZ7BNx38no4y9C8

Herjanto, E. (2008). *Manajemen operasi (edisi 3)*. PT Grasindo.

Hidayat, A. S. N. (2020). *14311683 Agung Setiawan Nur Hidayat*.

Jayadi, M. (2021). *Pengendalian Persediaan Deterministik Dinamis pada Bahan Baku Bata Ringan AAC (Autoclaved Aerated Concrete) Menggunakan Wagner-Within Algorithm dan Silver-Meal Algorithm (Studi Kasus: PT. Bumi Sarana Beton)*.

Juliana, H., & Handayani, N. U. (2016). Peningkatan kapasitas gudang dengan perancangan layout menggunakan metode class-based storage. *Jurnal Teknik Industri*, *11*(2).

Kristyaningrum, Y. E. D., Ekowati, T., & Setiyadi, A. (2017). *Efisiensi persediaan beras pada perusahaan umum bulog divisi regional jawa timur*.

Nasution, A. H. (1999). *Perencanaan dan pengendalian produksi*. PT. Candimas Metropole.

Perum BULOG. (2021). *Laporan Tahunan: Reorientasi Fokus Bisnis Untuk Kinerja Unggul Business Focus Reorientation for Excellent Performance*. www.bulog.co.id.

Perum BULOG. (2023, June 1). *Bersama Mewujudkan Kedaulatan Pangan*. https://www.bulog.co.id/

Prambodo, R. W. (2013). *Perencanaan Kebutuhan Material Dengan Penggunaan Algor1tma Wagner Within*.

Rais, M. R. A. H. (2020). *Perencanaan Persediaan Spare Part Shutdown Boiler Berdasarkan Analisis Multi Unit Spares Inventory Control-Three Dimensional Approach (Music-3d) Dengan Simulasi Monte Carlo (Studi Kasus Material Planning and Warehouse Section, PT. Badak NGL)*.

Ravitch S. M. & Carl, M. N. (2021). *Qualitative Research: Bridging the Conceptual, Theoretical, and Methodological.* (2nd Edition). Sage Publications.

Raymond, T. (2013). *Mengelola Persediaan RS untuk Menguragi Biaya*. https://mvpjogja.com/mengelola-persediaan-rs-untuk-mengurangi-biaya-part-1/

Rezani, O. D. N. (2019). *Peramalan Pengadaan Gabah Beras Tahun 2019 di Kabupaten Sumbawa dan Sumbawa Besar*.

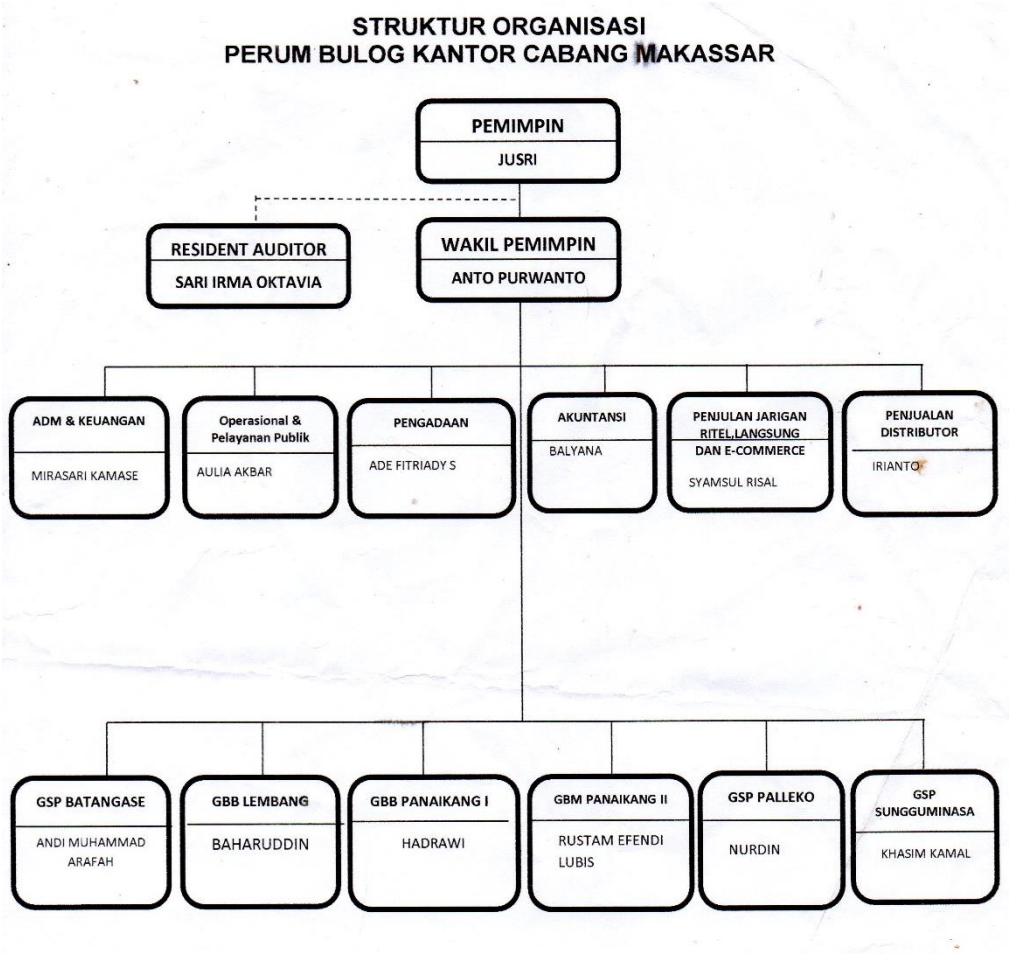
Rusdiana, H. A. (2014). *Manajemen Operasi*.

Tegtmeyer, J. (2022). *Building a Dissertation Conceptual and Theoretical Framework: A Recent Doctoral Graduate Narrates Behind the Curtain Development* . https://urbanedjournal.gse.upenn.edu/archive/volume-20-issue-1-fall-2022/building-dissertation-conceptual-and-theoretical-framework

Widyaningrum, R. (2017). *Analisis Pengendalian Persediaan Bahan Baku dalam Upaya Menekan Biaya Produksi pada UD.Sumber Mulya di Tarakan*.

LAMPIRAN

Lampiran 1 Struktur Organisasi Perum BULOG Subdivre Makassar



Lampiran 2 Kerangka data penelitian

Kerangka Data Penelitian

Nama Mahasiswa : Irfanita Nurhidayah Hasan
Stambuk : D22116510
Judul Tugas Akhir : Pengendalian Persediaan Beras Menggunakan Metode *Lot Sizing* pada Perum BULOG Divre Sulselbar

Berdasarkan proposal yang telah diajukan, penelitian ini bertujuan untuk mengetahui hasil perencanaan persediaan beras menggunakan metode *lot sizing*. Dalam penggunaan metode tersebut dibutuhkan data sebagai berikut:

1. Struktur Organisasi Perusahaan
2. Bisnis Proses Perusahaan
3. Divre Sulselbar
    a. Jumlah Subdivre
    b. Jumlah kabupaten/ kota
    c. Total jumlah seluruh karyawan
    d. Jumlah kompleks gudang dan jumlah unit gudang
    e. Kapasitas total seluruh gudang
    f. Jumlah unit bisnis pengolahan gabah beras (BPGB)
    g. Jumlah unit BULOGmart Corner
    h. Jumlah unit satgas
4. Penjualan
    a. Data penjualan beras tahun 2021 sampai 2022 dan harga penjualannya
    b. Data penjualan produk lainnya
    c. Jenis *customer* (pelanggan) komersial
5. *Inventory* (Persediaan)
    a. Biaya Simpan (perbulan)
        - Alat tulis kantor
        - Listrik
        - Air
        - Upah Keamanan (*Security*)
        - Upah buruh gudang
        - Upah Karyawan gudang
        - Sewa gudang (jika disewa)/ pajak

- *Maintenance* gudang dan produk (seperti fumigasi)

b. *Safety Stock* (persediaan pengaman)

c. Risiko kehabisan *stock* berapa persen (*service level*)

- Data *stock out*
- *Stock out cost*

d. *Warehouse* (Gudang)

- Jumlah unit gudang divre Sulselbar
- Kapasitas gudang divre Sulselbar

e. Rata- rata persediaan penyaluran perbulan

f. Rata -rata persediaan produk lain perbulan

g. Rincian penyaluran beras

6. *Procurement* (Pengadaan)

a. Biaya Pemesanan (per sekali pesan)

- Bahan bakar minyak
- Sopir
- Buruh Angkut
- Alat tulis kantor/ administrasi
- Perawatan Kendaraan

b. Kapasitas kendaraan

c. Metode *forecasting* (peramalan) perusahaan (kualitatif/ kuantitatif)

d. *Lead time* (waktu tunggu)

- Waktu tunggu tiap mitra *supplier*

e. *Supplier* (Pemasok)

- Sumber pengadaan beras
- Jumlah mitra tiap jenis
- Kapasitas total pengiriman beras perbulan

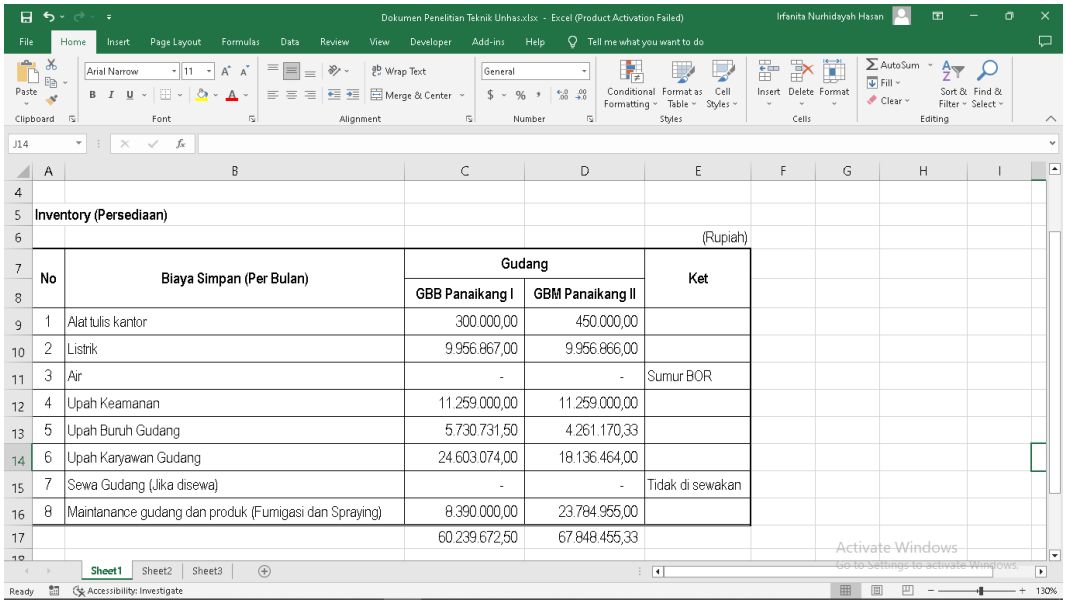
Lampiran 3 *Warehouse* Perum BULOG Divre Sulselbar

KOMPLEK PERGUDANGAN KANWIL SULSEL DAN SULBAR

No. KODE GD	GUDANG		
	KC / KCP	KAPASITAS	
		UNIT	TAMPUNG
1	**KC POLMAN**	**10**	**15.500.000**
011	GBL/GSP.POLEWALI/AMMASSANGGANG	3	3.500.000
012	GSP/GBB. CAMPURJO	5	10.000.000
023	GSP/GBB. RANGAS	2	2.000.000
2	**KC PAREPARE**	**20**	**135.000.000**
012	GBB.SOREANG	7	30.500.000
013	GSP MADELLO	4	4.500.000
015	GBM.LAPADDE I	3	30.000.000
025	GBM LAPADDE II	3	30.000.000
035	GBM LAPADDE III	4	40.000.000
3	**KCP PINRANG**	**19**	**36.500.000**
022	GBB MACCORAWALIE	2	7.000.000
023	GSP LAMAJAKKA I	9	16.000.000
032	GBB LAMPA	2	4.000.000
033	GSP LAMAJAKKA II	4	4.000.000
042	GBB LAMAJAKKA III	2	5.500.000
4	**KC SIDRAP**	**32**	**47.750.000**
012	GBB ULUALE	2	7.000.000
013	GSP PANGKAJENE	9	9.000.000
021	GBB TANETE	3	7.750.000
022	GBB PONRANGAE I	2	7.000.000
032	GBB CEMPA JAWAE	1	2.000.000
033	GSP PONRANGAE II	3	3.000.000
041	GBB LANRANG	2	2.000.000
043	GSP PADANG LOANG I	3	3.000.000
053	GSP ARAWA	7	7.000.000
5	**KCP SOPPENG**	**7**	**8.500.000**
011	GBL PADANG LOANG II	1	2.500.000
013	GSP PANINCONG	6	6.000.000
6	**KC WAJO**	**14**	**21.750.000**
012	GBB LAURENG	2	7.000.000
013	GSP LEMPA	3	2.750.000
022	GBB MATTIROWALIE I	1	3.500.000
023	GSP ONGKOE	3	3.500.000
032	GSP MATTIROWALIE II	4	4.000.000
052	GBB CIROMANIE	1	1.000.000
7	**KCP BONE**	**19**	**22.300.000**
013	GBB/GSP BIRU 1	2	3.000.000
023	GSP. APALA	4	6.000.000
033	GSP. TANETE	3	3.000.000
043	GSP. GARECCING	3	3.000.000
053	GSP SELLI	4	4.000.000

No. KODE GD	GUDANG		
	KC / KCP	KAPASITAS	
		UNIT	TAMPUNG
063	GSP/GBL BIRU 2	3	3.300.000
8	**KC BULUKUMBA**	**21**	**21.200.000**
013	MARIO RENNU	7	7.000.000
022	PALAMBARAE	4	4.600.000
032	EMPOANG	4	3.600.000
042	SAUKANG	2	2.000.000
052	LEMBANG	4	4.000.000
9	**KCP SELAYAR**	**1**	**1.000.000**
014	KOLO-KOLO	1	1.000.000
10	**SUBDIVRE PALOPO**	**29**	**28.100.000**
012	GBB BARA I	4	6.500.000
013	GSP PAMMANU	5	5.000.000
014	GDT TONDONLANGI'	2	1.000.000
022	GBB PATILA	5	5.000.000
023	GSP BARA II	9	8.600.000
032	GBB MALEKU	4	2.000.000
11	**SUBDIVRE MAKASSAR**	**26**	**60.000.000**
012	GBB PANAIKANG I	6	21.000.000
021	GBL PANAIKANG III	3	6.000.000
043	GSP SUNGGUMINASA	2	2.000.000
073	GSP BATANGNGASE	4	4.000.000
083	GSP PALLEKO	4	4.000.000
092	GBB LEMBANG & SAPANANG	2	2.000.000
112	GBM PANAIKANG II	5	21.000.000
12	**SUBDIVRE MAMUJU**	**3**	**3.000.000**
022	GBB SIMBORO	2	2.000.000
023	GBB MARTAJAYA	1	1.000.000
	JUMLAH 1 - 12	**201**	**400.600.000**

Lampiran 4 Biaya penyimpanan GBB Panaikang I dan GBM Panaikang II



Dokumen Penelitian Teknik Unhas.xlsx - Excel (Product Activation Failed)

Inventory (Persediaan)

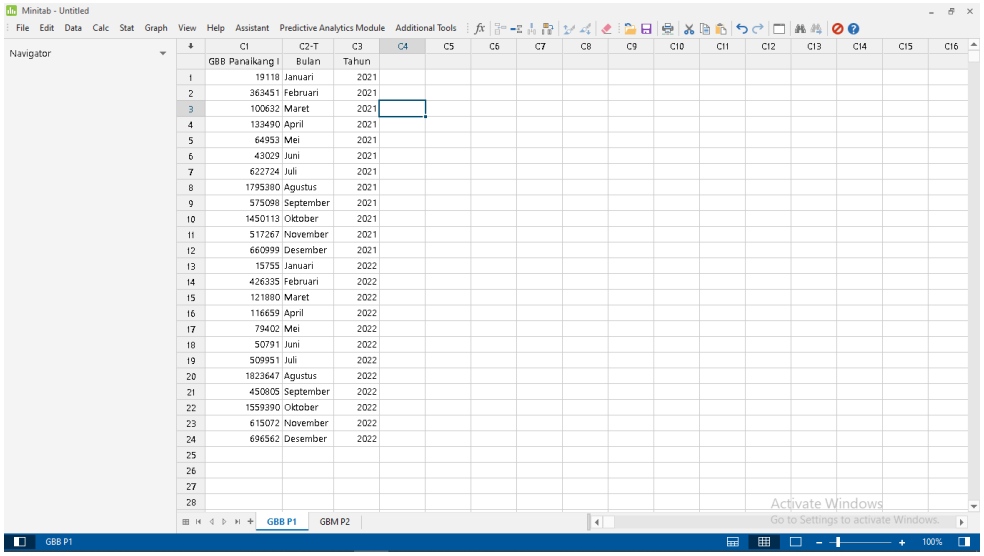
(Rupiah)

No	Biaya Simpan (Per Bulan)	Gudang		Ket
		GBB Panaikang I	GBM Panaikang II	
1	Alat tulis kantor	300.000,00	450.000,00	
2	Listrik	9.956.867,00	9.956.866,00	
3	Air	-	-	Sumur BOR
4	Upah Keamanan	11.259.000,00	11.259.000,00	
5	Upah Buruh Gudang	5.730.731,50	4.261.170,33	
6	Upah Karyawan Gudang	24.603.074,00	18.136.464,00	
7	Sewa Gudang (Jika disewa)	-	-	Tidak di sewakan
8	Maintanance gudang dan produk (Fumigasi dan Spraying)	8.390.000,00	23.784.955,00	
		60.239.672,50	67.848.455,33	

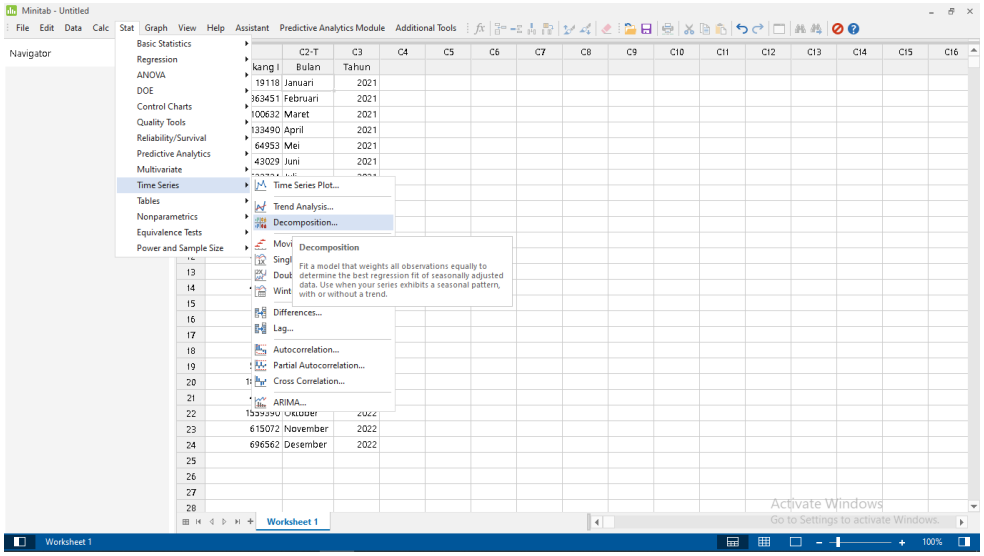
Lampiran 5 Tahapan perhitungan *forecasting* menggunakan metode *Decomposition Additive*, *Decomposition Multiplicative*, Holt Winters' *Additive* dan Holt Winters' *Multiplicative* dengan Minitab *Statistical Software* 20 pada GBB Panaikang I dan GBM Panaikang II

1. Metode *Decomposition Additive* GBB Panaikang I

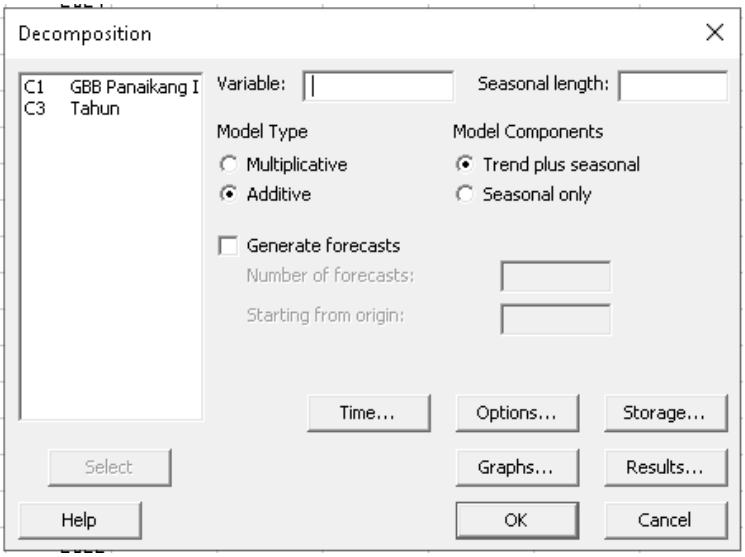
   a. *Input* data penjualan beras beras GBB Panaikang I, Bulan dan Tahun.



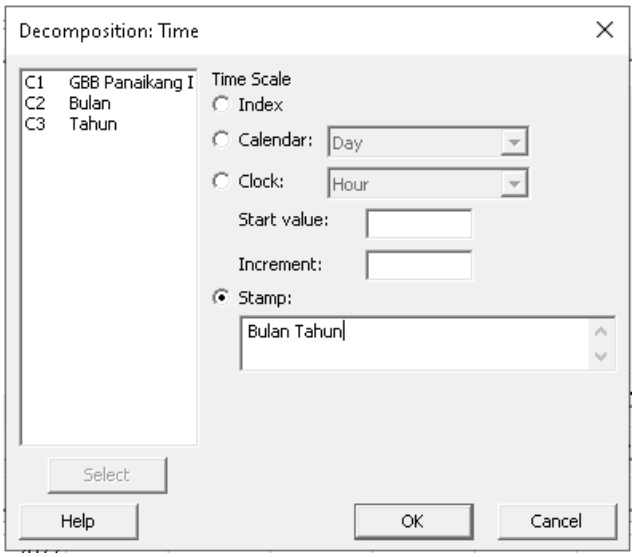
   b. Pada tab *Stat*, pilih *Time Series* kemudian pilih *Decomposition*.



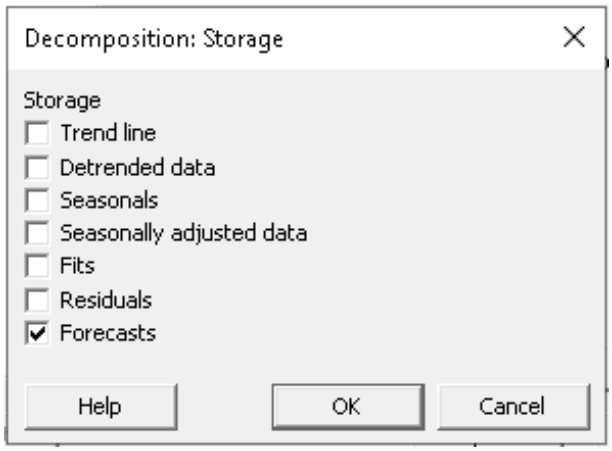
c. Klik pada kolom *Variable* kemudian *double click* pada C1 GBB Panaikang I. kemudian klik kolom *Seasonal length* dan *input* angka 12. Dan pilih *Additive* pada *Model Type*. Pada *Model Components* pilih *Trend plus seasonal*. Lalu klik *Generate forecast*, pada *Number of forecast input* angka 12.



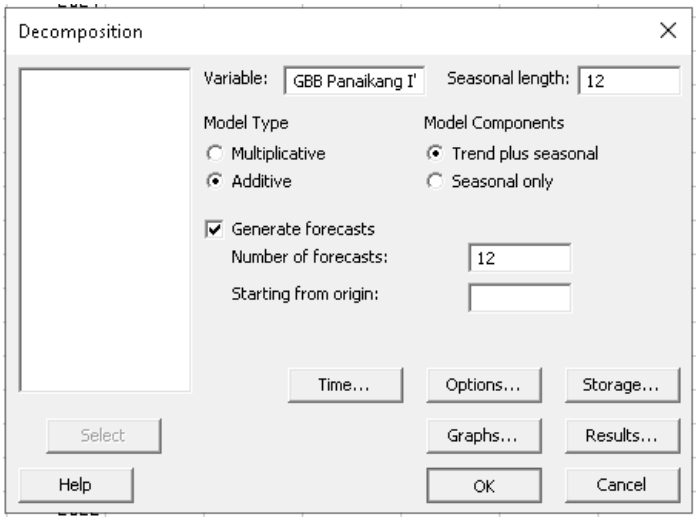
d. Kemudian klik *Tab Time*…, keudian pada *Time Scale* pilih *Stamp* dan klik pada kolom dibawahnnya. Kemudian *double click* pada C2 Bulan dan C3 Tahun. Lalu klik OK



e. Klik Tab *Storage* kemudian pilih *Forecasts* lalu klik OK



f. Kemudian klik OK



g. Hasil Output untuk GBB Panaikang I menggunakan metode *Decomposition Additive* adalah sebagai berikut

Time Series Decomposition for GBB Panaikang I

Method

Model type	Additive Model
Data	GBB Panaikang I
Length	24
NMissing	0

Fitted Trend Equation

Yt = 512428 + 1714×t

Seasonal Indices

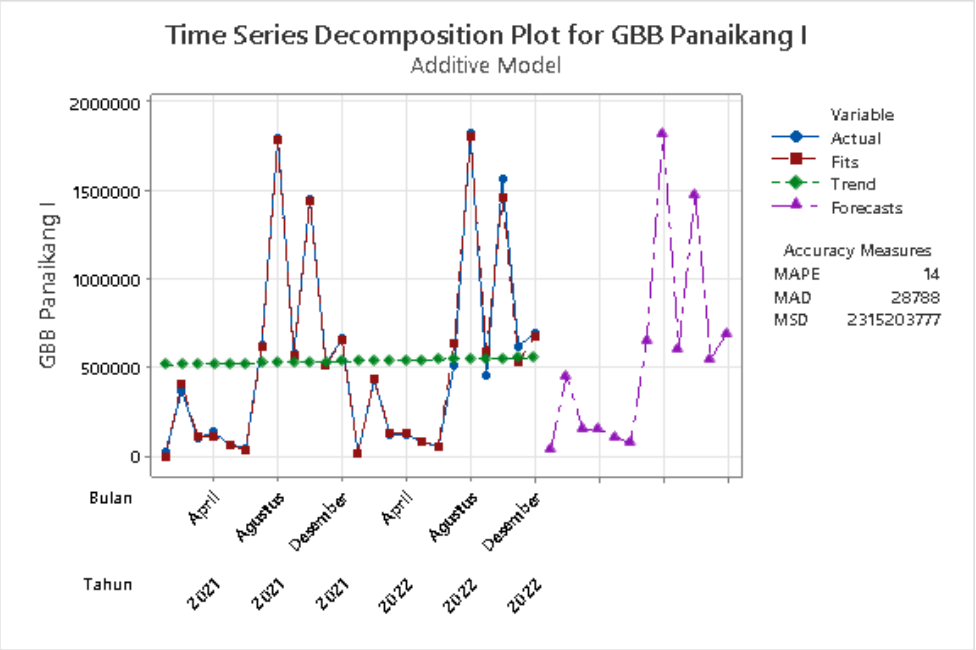
Period	Index
1	-520336
2	-106235
3	-406689
4	-411285
5	-457170
6	-491338
7	89253
8	1259429
9	35641
10	910472
11	-22274
12	120532

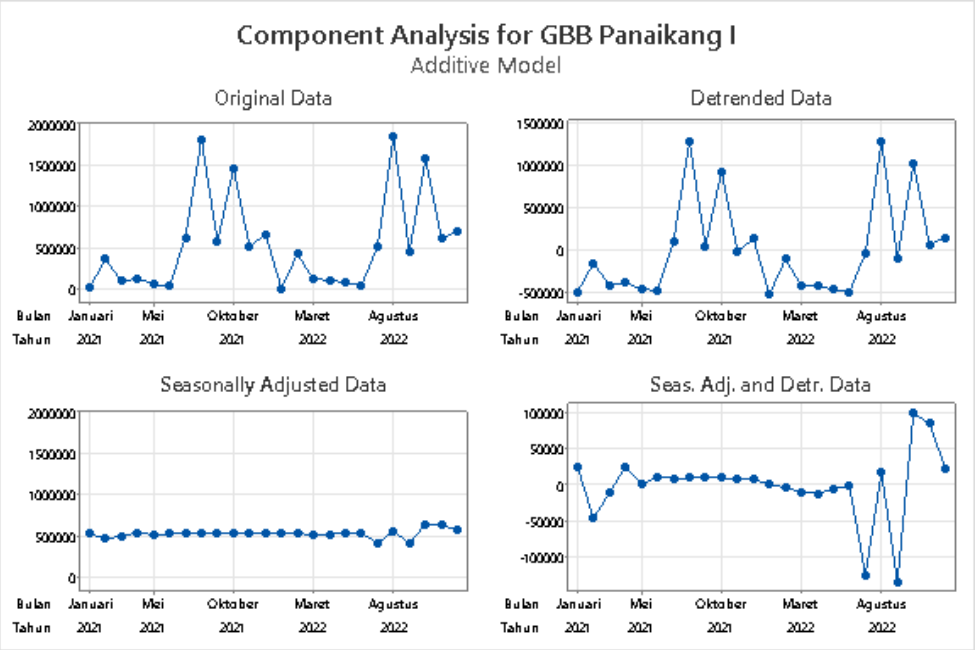
Accuracy Measures

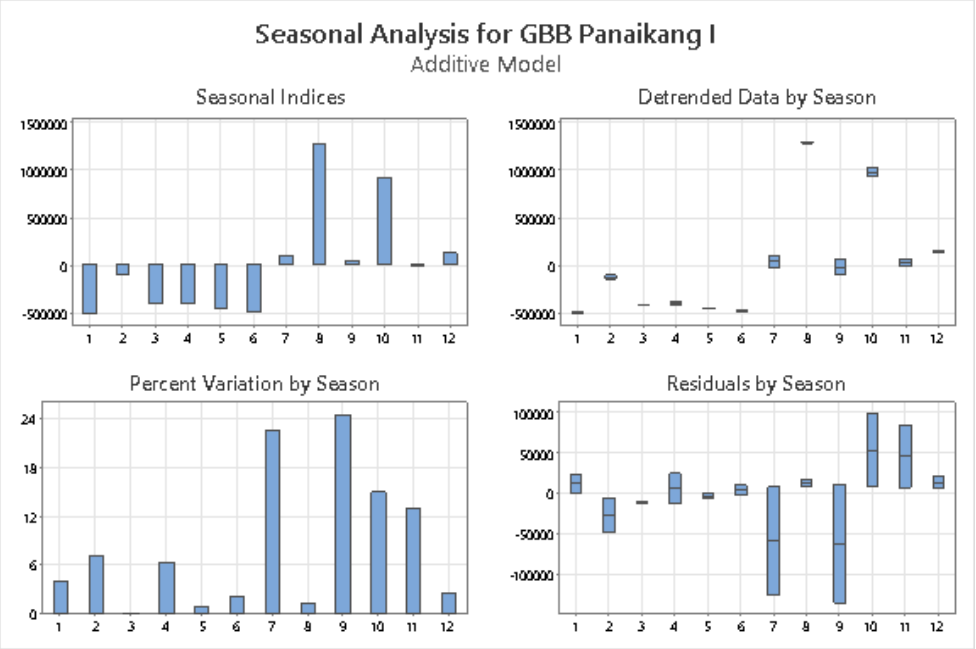
MAPE	14
MAD	28788
MSD	2315203777

Forecasts

Period	Forecast
25	34944
26	450759
27	152019
28	149138
29	104966
30	72513
31	654818
32	1826708
33	604634
34	1481179
35	550146
36	694667

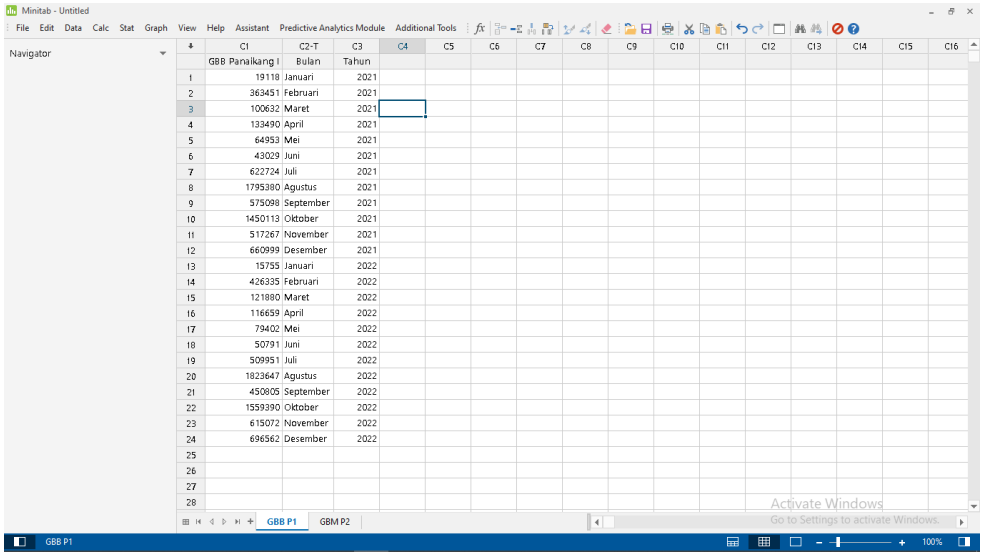



Component Analysis for GBB Panaikang I
Additive Model
Original Data
Detrended Data
Seasonally Adjusted Data
Seas. Adj. and Detr. Data
Bulan Januari Mei Oktober Maret Agustus
Tahun 2021 2021 2021 2022 2022

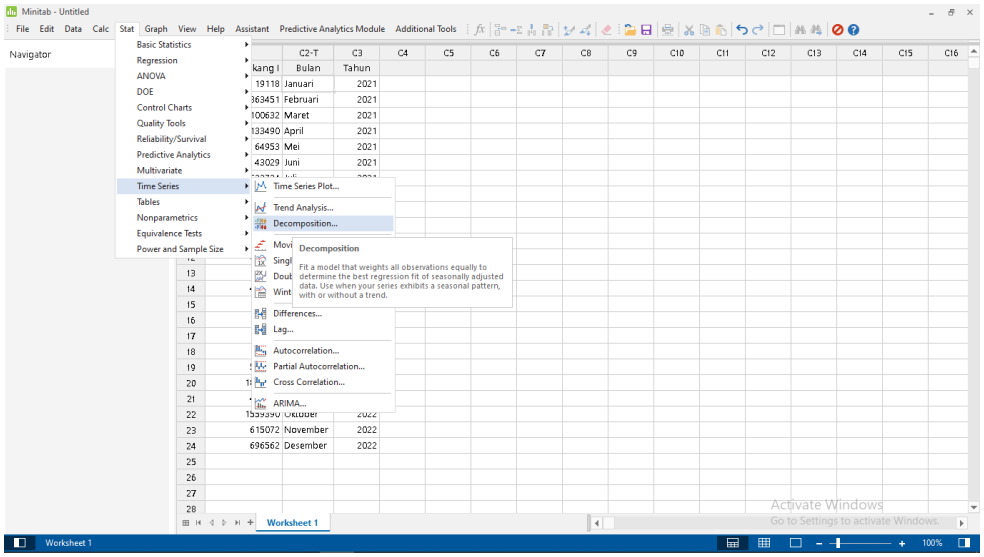

Seasonal Analysis for GBB Panaikang I
Additive Model
Seasonal Indices
Detrended Data by Season
Percent Variation by Season
Residuals by Season

2. Metode *Decomposition Multiplicative* GBB Panaikang I

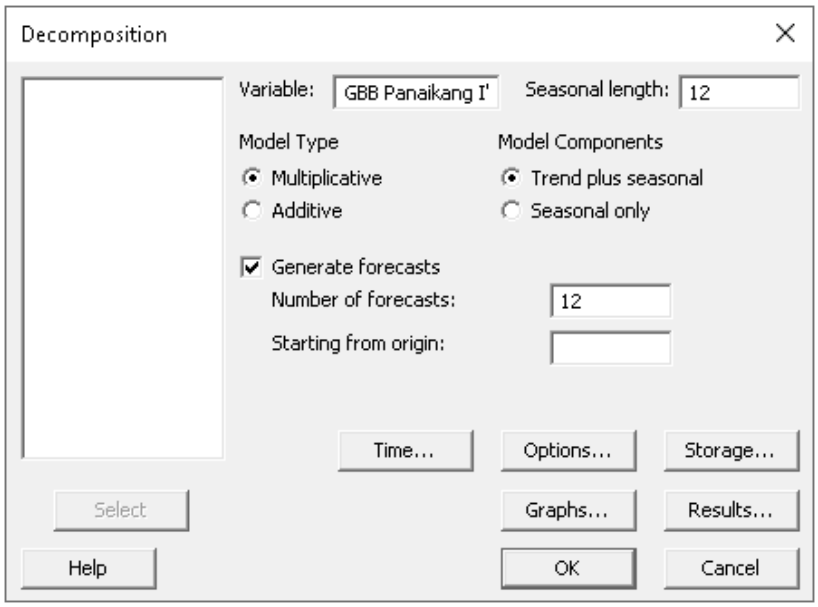
   a. *Input* data penjualan beras beras GBB Panaikang I, Bulan dan Tahun.



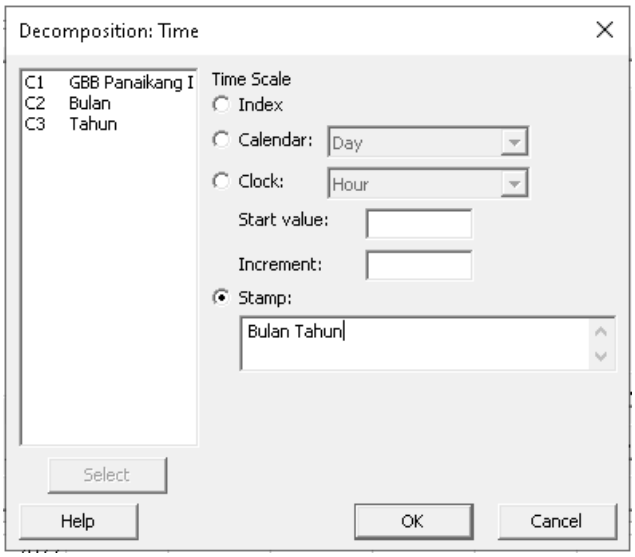
   b. Pada tab *Stat*, pilih *Time Series* kemudian pilih *Decomposition*.



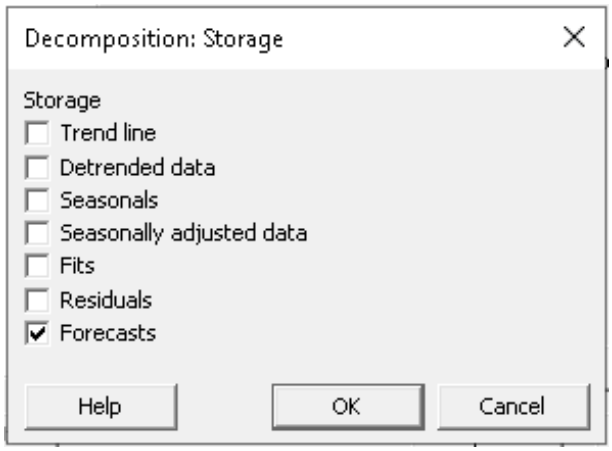
c. Klik pada kolom *Variable* kemudian *double click* pada C1 GBB Panaikang I. kemudian klik kolom *Seasonal length* dan *input* angka 12. Dan pilih *Multiplicative* pada *Model Type*. Pada *Model Components* pilih *Trend plus seasonal*. Lalu klik *Generate forecast*, pada *Number of forecast input* angka 12.



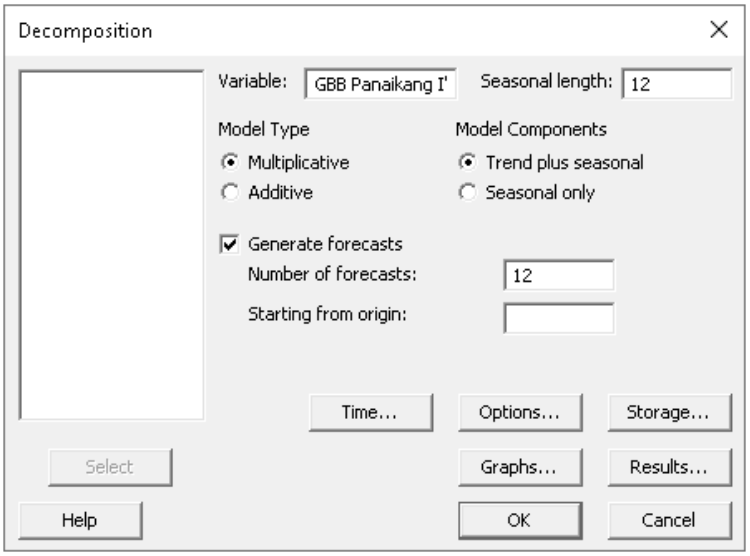
d. Kemudian klik *Tab Time*…, keudian pada *Time Scale* pilih *Stamp* dan klik pada kolom dibawahnnya. Kemudian *double click* pada C2 Bulan dan C3 Tahun. Lalu klik OK



e. Klik Tab *Storage* kemudian pilih *Forecasts* lalu klik OK



f. Kemudian klik OK



g. Hasil Output untuk GBB Panaikang I menggunakan metode *Decomposition Multiplicative* adalah sebagai berikut

Time Series Decomposition for GBB Panaikang I

Method

Model type	Multiplicative Model
Data	GBB Panaikang I
Length	24
NMissing	0

Fitted Trend Equation

Yt = 510803 + 1286×t

Seasonal Indices

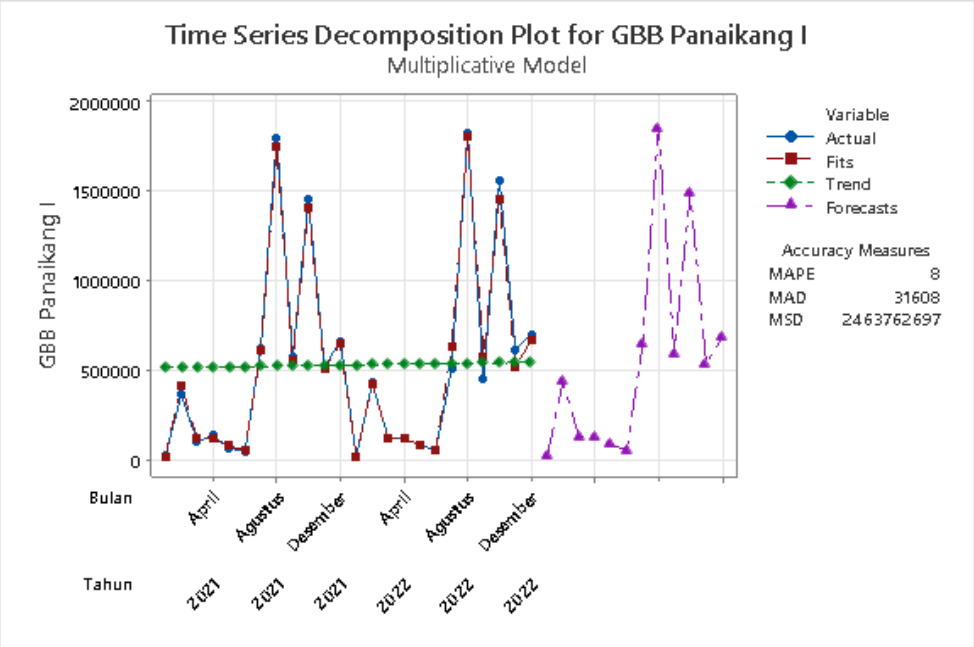
Period	Index
1	0.02945
2	0.80223
3	0.23109
4	0.22146
5	0.14829
6	0.09387
7	1.16978
8	3.35687
9	1.06823
10	2.69261
11	0.96065
12	1.22547

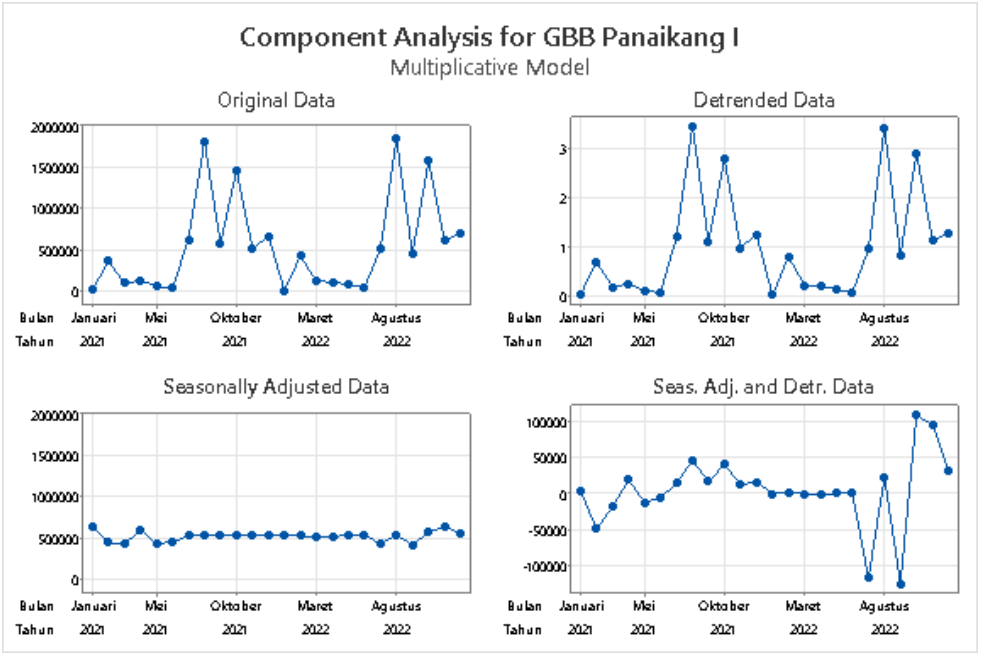
Accuracy Measures

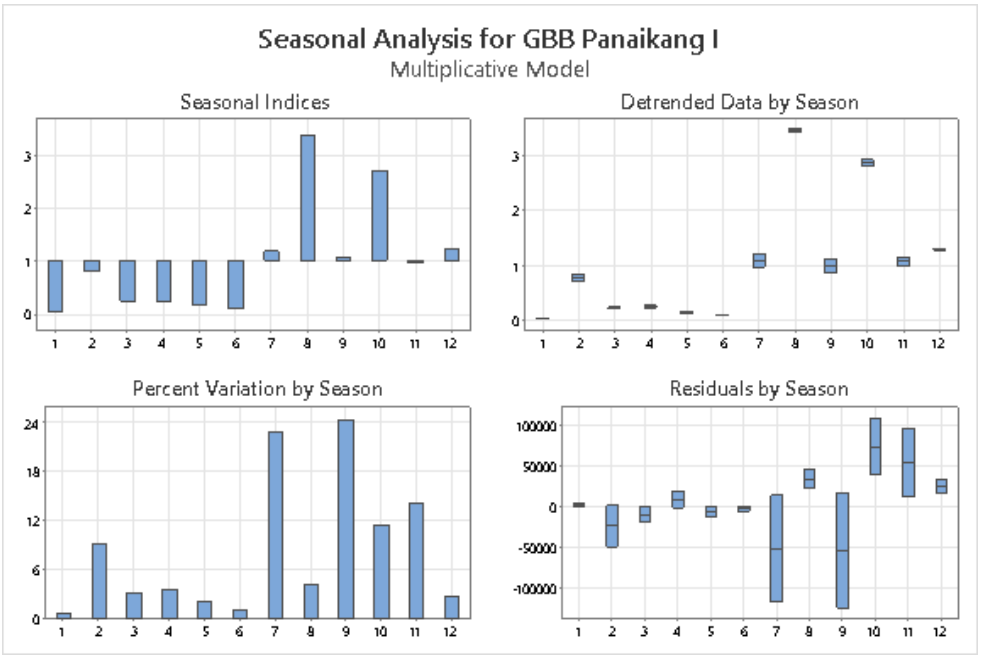
MAPE	8
MAD	31608
MSD	2463762697

Forecasts

Period	Forecast
25	15989
26	436598
27	126064
28	121093
29	81273
30	51571
31	644147
32	1852788
33	590969
34	1493082
35	533928
36	682686

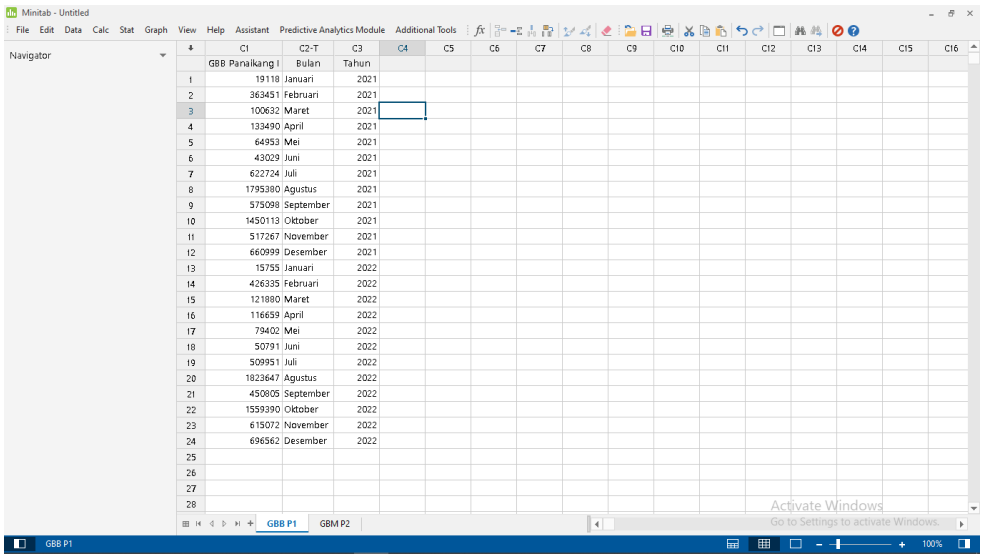



Component Analysis for GBB Panaikang I
Multiplicative Model
Original Data
Detrended Data
Seasonally Adjusted Data
Seas. Adj. and Detr. Data
Bulan Januari Mei Oktober Maret Agustus
Tahun 2021 2021 2021 2022 2022

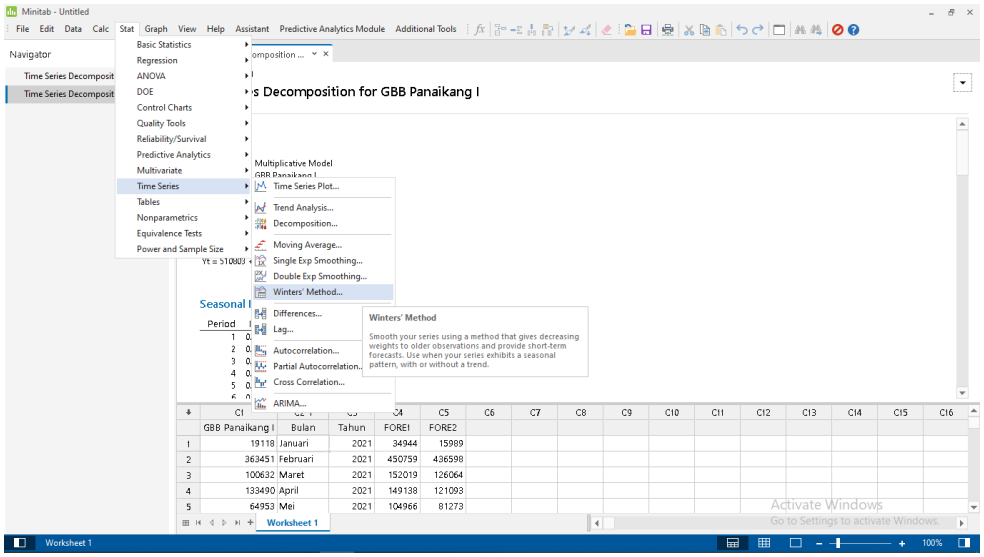

Seasonal Analysis for GBB Panaikang I
Multiplicative Model
Seasonal Indices
Detrended Data by Season
Percent Variation by Season
Residuals by Season

3. Metode Holt Winters' *Additive* GBB Panaikang I

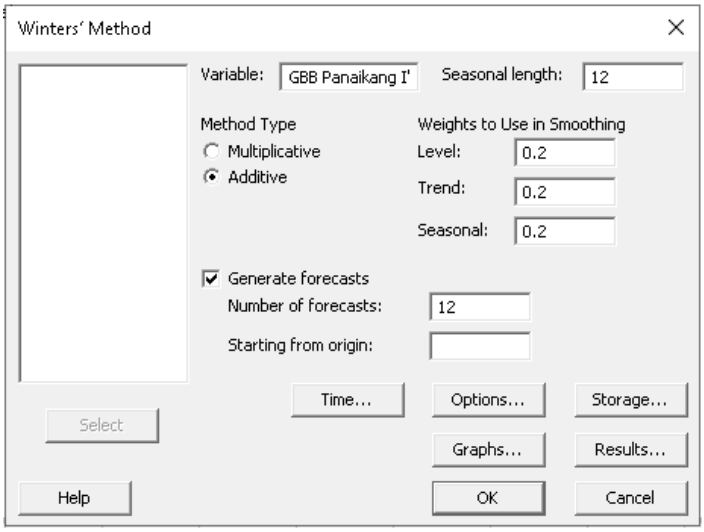
   a. *Input* data penjualan beras beras GBB Panaikang I, Bulan dan Tahun.



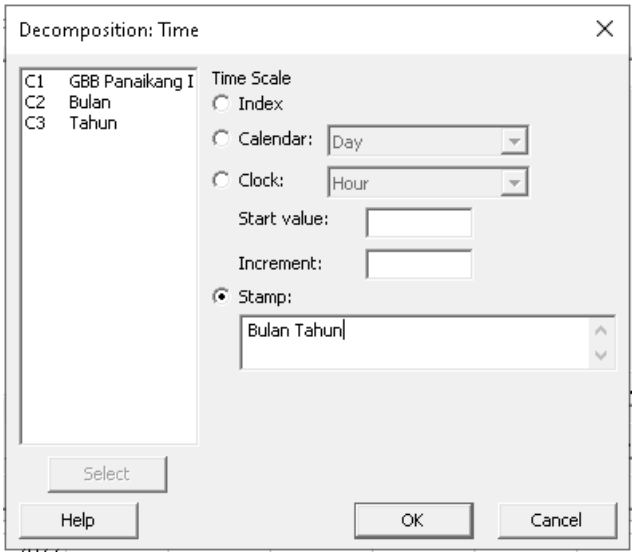
   b. Pada tab *Stat*, pilih *Time Series* kemudian pilih *Winters' Method*.



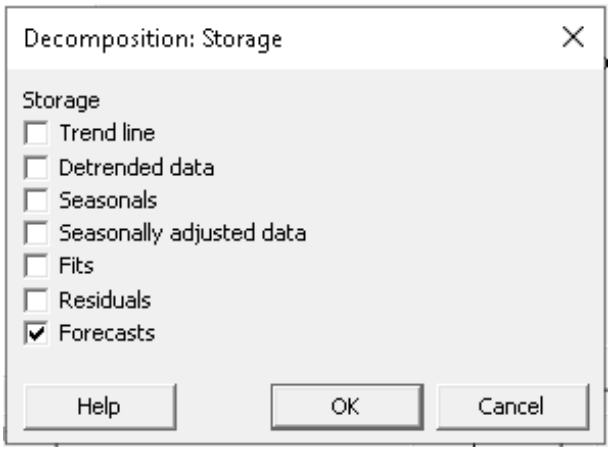
c. Klik pada kolom *Variable* kemudian *double click* pada C1 GBB Panaikang I. kemudian klik kolom *Seasonal length* dan *input* angka 12. Dan pilih *Additive* pada *Model Type*. Pada *Weights to Use in Smoothing* isi nilai Level, Trend, dan Seasonal masing- masing 0.2. Lalu klik *Generate forecast*, pada *Number of forecast input* angka 12.



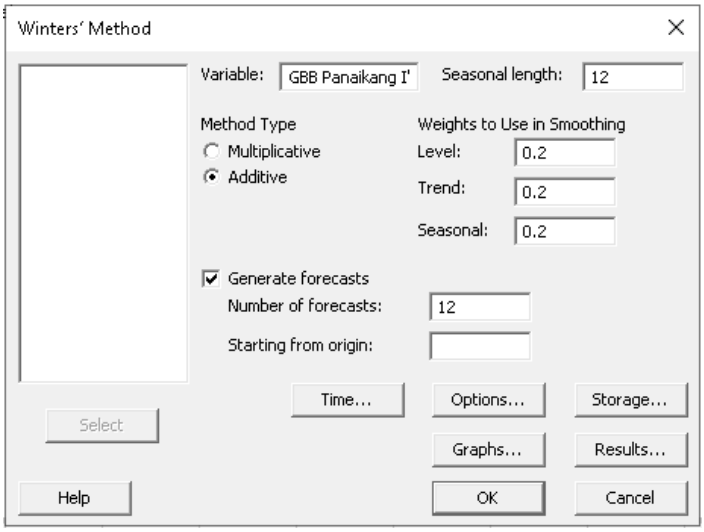
d. Kemudian klik *Tab Time*…, keudian pada *Time Scale* pilih *Stamp* dan klik pada kolom dibawahnnya. Kemudian *double click* pada C2 Bulan dan C3 Tahun. Lalu klik OK



e. Klik Tab *Storage* kemudian pilih *Forecasts* lalu klik OK



f. Kemudian klik OK



g. Hasil Output untuk GBB Panaikang I menggunakan metode Holt Winters' *Additive* adalah sebagai berikut

Winters' Method for GBB Panaikang I

Method

Model type	Additive Method
Data	GBB Panaikang I
Length	24

Smoothing Constants

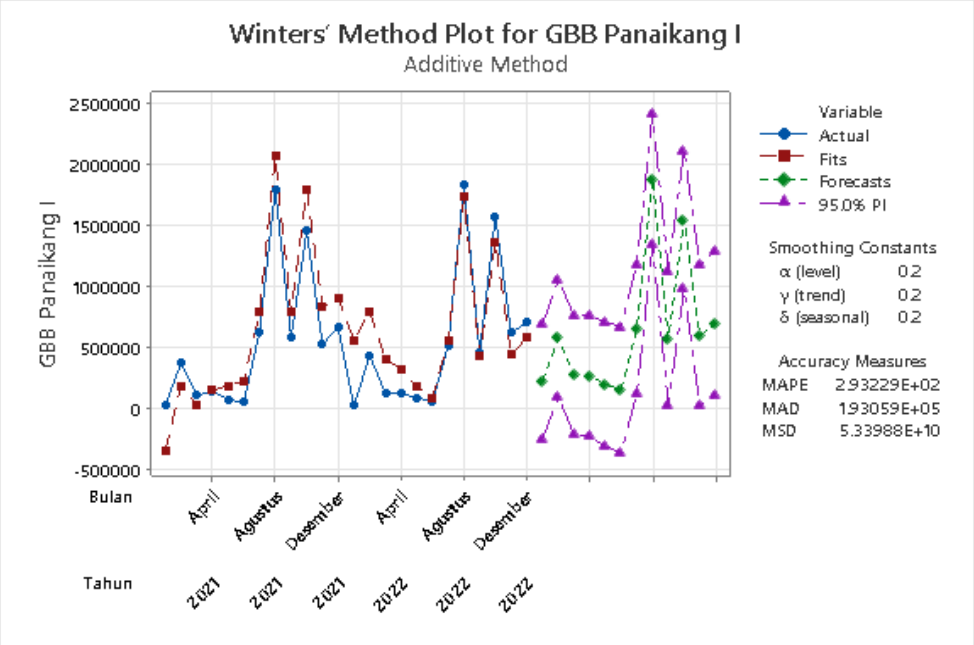
α (level)	0.2
γ (trend)	0.2
δ (seasonal)	0.2

Accuracy Measures

MAPE	2.93229E+02
MAD	1.93059E+05
MSD	5.33988E+10

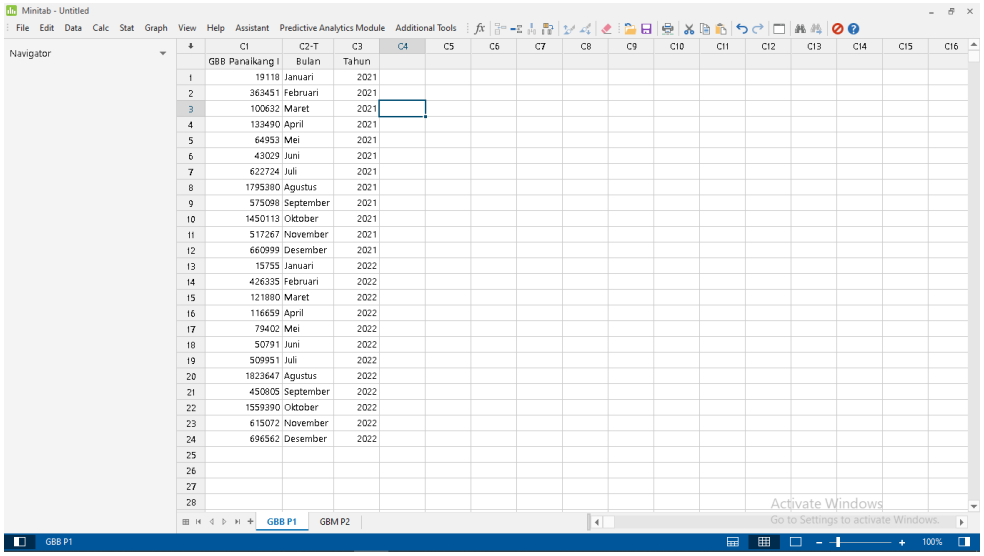
Forecasts

Period	Forecast	Lower	Upper
25	213548	-259437	686534
26	570715	90320	1051110
27	266318	-222339	754976
28	260879	-236851	758608
29	190827	-316741	698395
30	148503	-369626	666633
31	650129	120760	1179499
32	1880127	1338880	2421375
33	566037	12316	1119758
34	1546519	979767	2113271
35	592109	11808	1172411
36	688563	94228	1282898

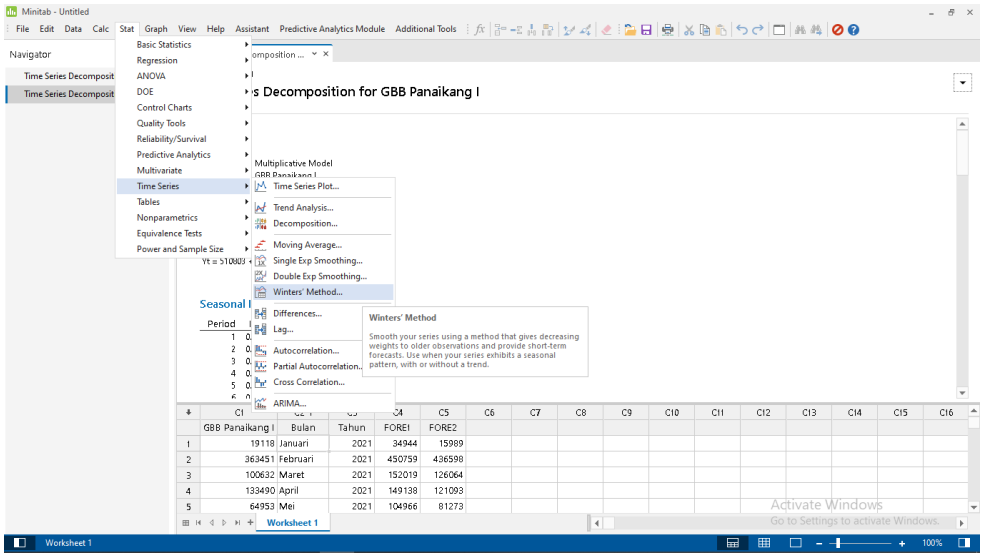


4. Metode Holt Winters' *Multiplicative* GBB Panaikang I

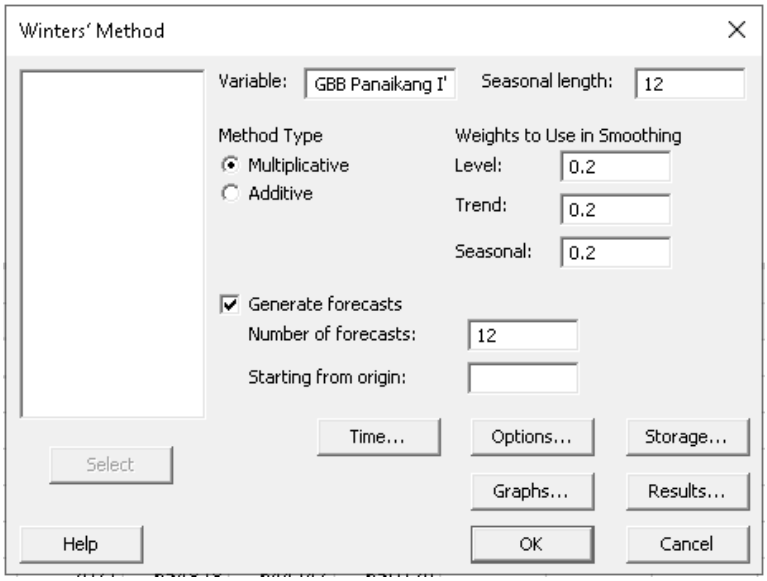
   a. *Input* data penjualan beras beras GBB Panaikang I, Bulan dan Tahun.



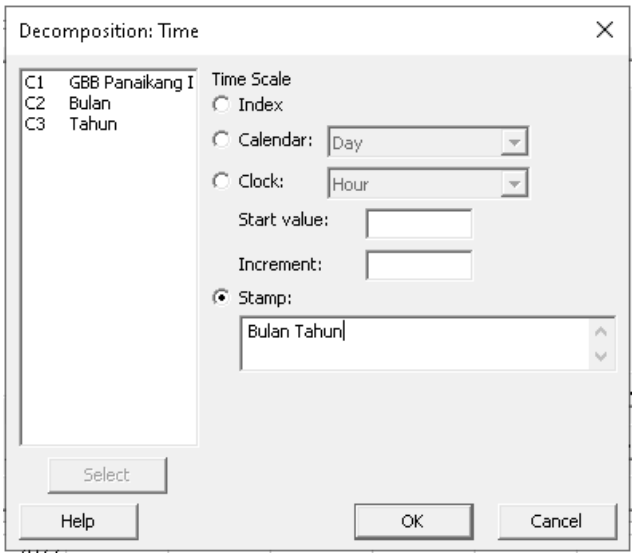
   b. Pada tab *Stat*, pilih *Time Series* kemudian pilih *Winters' Method*.



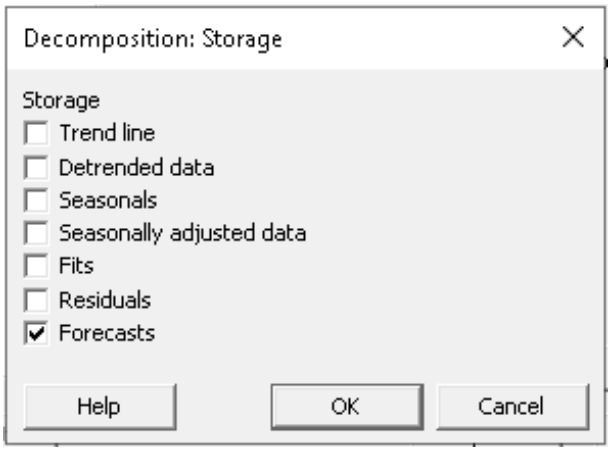
c. Klik pada kolom *Variable* kemudian *double click* pada C1 GBB Panaikang I. kemudian klik kolom *Seasonal length* dan *input* angka 12. Dan pilih *Multiplicative* pada *Model Type*. Pada *Weights to Use in Smoothing* isi nilai Level, Trend, dan Seasonal masing- masing 0.2. Lalu klik *Generate forecast*, pada *Number of forecast input* angka 12.



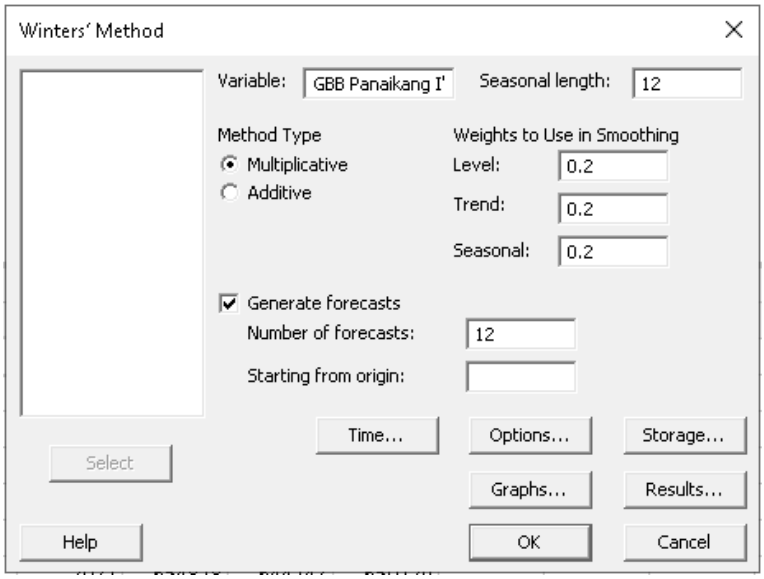
d. Kemudian klik *Tab Time*…, keudian pada *Time Scale* pilih *Stamp* dan klik pada kolom dibawahnnya. Kemudian *double click* pada C2 Bulan dan C3 Tahun. Lalu klik OK



e. Klik Tab *Storage* kemudian pilih *Forecasts* lalu klik OK



f. Kemudian klik OK



g. Hasil Output untuk GBB Panaikang I menggunakan metode Holt Winters' *Multiplicative* adalah sebagai berikut

Winters' Method for GBB Panaikang I

Method

Model type	Multiplicative
Method	
Data	GBB Panaikang I
Length	24

Smoothing Constants

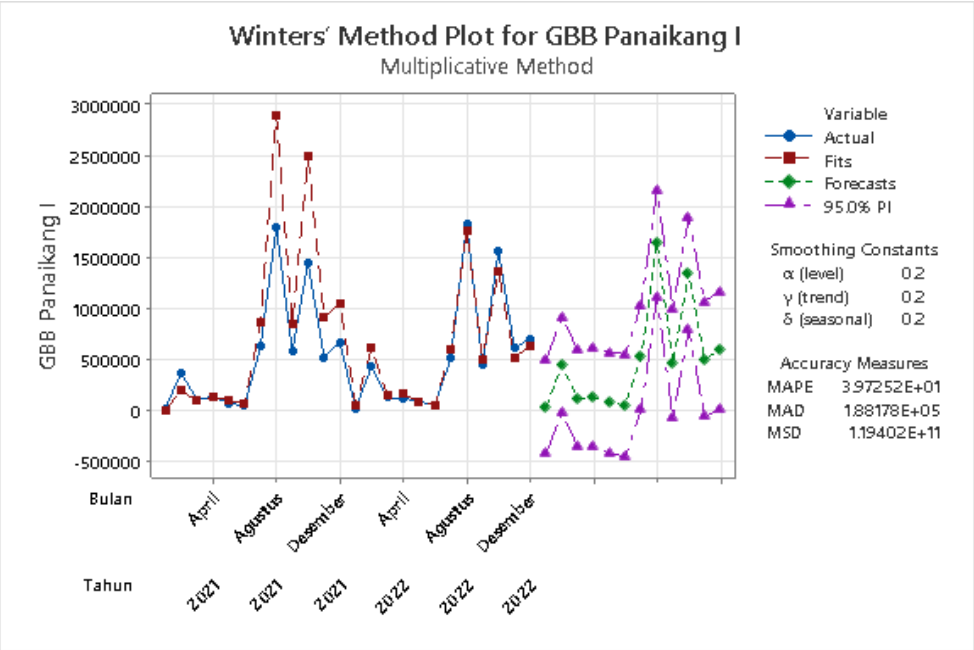
α (level)	0.2
γ (trend)	0.2
δ (seasonal)	0.2

Accuracy Measures

MAPE	3.97252E+01
MAD	1.88178E+05
MSD	1.19402E+11

Forecasts

Period	Forecast	Lower	Upper
25	26522	-434506	487551
26	440971	-27280	909222
27	114129	-362176	590433
28	122976	-362171	608124
29	69039	-425698	563777
30	43906	-461126	548937
31	518021	2033	1034009
32	1643644	1116079	2171209
33	457565	-82159	997288
34	1342799	790375	1895224
35	500068	-65564	1065700
36	590350	11039	1169660



Lampiran 6 Perhitungan MAD, MSE, dan MAPE menggunakan *software* Excel pada GBB Panaikang I

		Minitab *Statistical Software* 20			
	No	***Decomposition Additive***	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
ERROR	**1**	-19.189	-234	-197793	-10767
	2	-24.424	-10.263	-144380	-14636
	3	-30.139	-4.184	-144438	7751
	4	-32.479	-4.434	-144220	-6317
	5	-25.564	-1.871	-111425	10363
	6	-21.722	-780	-97712	6885
	7	-144.867	-134.196	-140178	-8070
	8	-3.061	-29.141	-56480	180003
	9	-153.829	-140.164	-115232	-6760
	10	78.211	66.308	12871	216591
	11	64.926	81.144	22963	115004
	12	1.895	13.876	7999	106212

		Minitab *Statistical Software* 20			
	No	***Decomposition Additive***	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
|ERROR|	**1**	19.189	234	197793	10767
	2	24.424	10.263	144380	14636
	3	30.139	4.184	144438	7751
	4	32.479	4.434	144220	6317
	5	25.564	1.871	111425	10363
	6	21.722	780	97712	6885
	7	144.867	134.196	140178	8070
	8	3.061	29.141	56480	180003
	9	153.829	140.164	115232	6760
	10	78.211	66.308	12871	216591
	11	64.926	81.144	22963	115004
	12	1.895	13.876	7999	106212
	MAD	**50.026**	**40.550**	**99640,91667**	**57446,58333**

	No	Minitab *Statistical Software* 20			
		Decomposition Additive	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
|ERROR|^2	**1**	368.217.721	54.976	39122070849	115928289
	2	596.531.776	105.320.343	20845584400	214212496
	3	908.359.321	17.508.412	20862335844	60078001
	4	1.054.885.441	19.660.849	20799408400	39904489
	5	653.518.096	3.502.046	12415530625	107391769
	6	471.845.284	608.599	9547634944	47403225
	7	20.986.447.689	18.008.450.482	19649871684	65124900
	8	9.369.721	849.216.754	3189990400	32401080009
	9	23.663.361.241	19.646.069.171	13278413824	45697600
	10	6.116.960.521	4.396.794.835	165662641	46911661281
	11	4.215.385.476	6.584.336.173	527299369	13225920016
	12	3.591.025	192.533.000	63984001	11280988944
	MSE	**4920706109**	**4152004637**	**13372315582**	**8709615918**

	No	Minitab *Statistical Software* 20			
		Decomposition Additive	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
|ERROR/ AKTUAL|	**1**	121,80	1,49	1.255,43	68,34
	2	5,73	2,41	33,87	3,43
	3	24,73	3,43	118,51	6,36
	4	27,84	3,80	123,63	5,41
	5	32,20	2,36	140,33	13,05
	6	42,77	1,54	192,38	13,56
	7	28,41	26,32	27,49	1,58
	8	0,17	1,60	3,10	9,87
	9	34,12	31,09	25,56	1,50
	10	5,02	4,25	0,83	13,89
	11	10,56	13,19	3,73	18,70
	12	0,27	1,99	1,15	15,25
	MAPE	**27,80**	**7,79**	**160,50**	**14,25**

Lampiran 7 Perhitungan MAD, MSE, dan MAPE menggunakan *software* Excel pada GBM Panaikang II

		Minitab *Statistical Software* 20			
	No	***Decomposition Additive***	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
ERROR	**1**	-33.256	-17.794	-148.119	21.155
	2	398.532	415.326	300.047	410.030
	3	37.269	60.605	-46.191	53.713
	4	88.475	109.497	17.099	107.731
	5	-7.669	17.784	-67.290	14.609
	6	-60.853	-34.525	-129.290	-54.100
	7	178.673	240.735	168.147	243.835
	8	1.681.680	1.715.509	1.641.394	1.698.993
	9	258.236	302.372	237.325	289.766
	10	1.450.790	1.481.741	1.454.984	1.494.357
	11	-457.777	-243.885	-533.993	-456.161
	12	106.374	233.482	89.191	138.821

		Minitab *Statistical Software* 20			
	NO	***Decomposition Additive***	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
|ERROR|	**1**	33.256	17.794	148.119	21.155
	2	398.532	415.326	300.047	410.030
	3	37.269	60.605	46.191	53.713
	4	88.475	109.497	17.099	107.731
	5	7.669	17.784	67.290	14.609
	6	60.853	34.525	129.290	54.100
	7	178.673	240.735	168.147	243.835
	8	1.681.680	1.715.509	1.641.394	1.698.993
	9	258.236	302.372	237.325	289.766
	10	1.450.790	1.481.741	1.454.984	1.494.357
	11	457.777	243.885	533.993	456.161
	12	106.374	233.482	89.191	138.821
	MAD	**396.632**	**406.104**	**402.756**	**415.273**

	NO	Minitab *Statistical Software* 20			
		Decomposition Additive	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
|ERROR| ^2	**1**	1.105.931.915	316.615.877	21.939.151.904	447.543.792
	2	158.828.091.456	172.495.294.253	90.028.479.300	168.124.265.852
	3	1.388.949.080	3.672.914.645	2.133.578.683	2.885.076.087
	4	7.827.774.115	11.989.542.099	292.374.287	11.605.940.105
	5	58.820.939	316.261.620	4.528.000.647	213.435.929
	6	3.703.143.913	1.191.957.254	16.715.777.826	2.926.829.278
	7	31.923.882.191	57.953.541.660	28.273.425.226	59.455.437.736
	8	2.828.046.610.671	2.942.970.619.541	2.694.175.752.404	2.886.578.443.665
	9	66.685.750.402	91.428.705.771	56.323.120.041	83.964.165.827
	10	2.104.791.946.182	2.195.557.840.880	2.116.978.485.448	2.233.101.742.886
	11	209.559.434.360	59.480.063.991	285.148.972.850	208.083.133.213
	12	11.315.459.323	54.513.802.085	7.954.982.534	19.271.280.740
	MSE	**452.102.982.879**	**465.990.596.640**	**443.707.675.096**	**473.054.774.593**

	NO	Minitab *Statistical Software* 20			
		Decomposition Additive	***Decomposition Multiplicative***	**Holt Winters' *Additive***	**Holt Winters' *Multiplicative***
|ERROR/ AKTUAL|	**1**	211,08	112,94	940,14	134,28
	2	93,48	97,42	70,38	96,18
	3	30,58	49,72	37,90	44,07
	4	75,84	93,86	14,66	92,35
	5	9,66	22,40	84,75	18,40
	6	119,81	67,97	254,55	106,52
	7	35,04	47,21	32,97	47,82
	8	92,22	94,07	90,01	93,16
	9	57,28	67,07	52,64	64,28
	10	93,04	95,02	93,30	95,83
	11	74,43	39,65	86,82	74,16
	12	15,27	33,52	12,80	19,93
	MAPE	**75,64**	**68,40**	**147,58**	**73,91**

Lampiran 8 Hasil Perhitungan *lot sizing* menggunakan Silver Meal *Heuristic* GBB Panaikang I

Demand (Kg)	OC (Juta Rp)	HC (Rp)	Periode	Pemesanan 1 (Rp)	Pemesanan 2 (Rp)	Pemesanan 3 (Rp)	Pemesanan 4 (Rp)
15.989	1,5	3	k1	1.500.000			
436.598	1,5	3	k2	1.376.203			
126.064	1,5	3	k3	1.158.550			
121.093	1,5	3	k4	1.129.434			
81.273	1,5	3	k5	1.090.056			
51.571	1,5	3	k6	**1.031.659**			
644.147	1,5	3	k7	2.468.083	**1.500.000**		
1.852.788	1,5	3	k8		3.407.413	**1.500.000**	
590.969	1,5	3	k9			1.597.614	**1.500.000**
1.493.082	1,5	3	k10				2.891.495
533.928	1,5	3	k11				
682.686	1,5	3	k12				
Min				**1.031.659**	**1.500.000**	**1.500.000**	**1.500.000**

Demand (Kg)	OC (Juta Rp)	HC (Rp)	Periode	Pemesanan 5 (Rp)	Pemesanan 6 (Rp)	Pemesanan 7 (Rp)	Pemesanan 8 (Rp)
15.989	1,5	3	k1				
436.598	1,5	3	k2				
126.064	1,5	3	k3				
121.093	1,5	3	k4				
81.273	1,5	3	k5				
51.571	1,5	3	k6				
644.147	1,5	3	k7				
1.852.788	1,5	3	k8				
590.969	1,5	3	k9				
1.493.082	1,5	3	k10	**1.500.000**			
533.928	1,5	3	k11	1.515.801	**1.500.000**		
682.686	1,5	3	k12		1.729.161	**1.500.000**	
Min				**1.500.000**	**1.500.000**	**1.500.000**	

Periode	Demand (Kg)	HC (Rp/Kg)	OC (Rp)	Penyimpanan (Bulan)	Pembanding	Hasil (Rp)
1	15989	3	1.500.000	0	1	1.500.000
1-2	436598	3	1.500.000	1	2	1.376.203
1-3	126064	3	1.500.000	2	3	1.158.550
1-4	121093	3	1.500.000	3	4	1.129.434
1-5	81273	3	1.500.000	4	5	1.090.056
1-6	51571	3	1.500.000	5	6	**1.031.659**
1-7	644147	3	1.500.000	6	7	2.468.083
7	644147	3	1.500.000	0	1	**1.500.000**
7-8	1852788	3	1.500.000	1	2	3.407.413
8	1852788	3	1.500.000	0	1	**1.500.000**
8-9	590969	3	1.500.000	1	2	1.597.614
9	590969	3	1.500.000	0	1	**1.500.000**
9-10	1493082	3	1.500.000	1	2	2.891.495
10	1493082	3	1.500.000	0	1	**1.500.000**
10-11	533928	3	1.500.000	1	2	1.515.801
11	533928	3	1.500.000	0	1	**1.500.000**
11-12	682686	3	1.500.000	1	2	1.729.161
12	682686	3	1.500.000	0	1	**1.500.000**

Lampiran 9 Hasil Perhitungan *lot sizing* menggunakan Silver Meal *Heuristic* GBM Panaikang II

Demand (Kg)	OC (Juta Rp)	HC (Rp)	Periode	Pemesanan 1 (Rp)	Pemesanan 2 (Rp)	Pemesanan 3 (Rp)	Pemesanan 4 (Rp)
163,874	1,5	3	k1	1,500,000			
126,288	1,5	3	k2	**954,011**			
168,071	1,5	3	k3	998,018	1,500,000		
99,560	1,5	3	k4		**910,833**		
146,692	1,5	3	k5		923,185	1,500,000	
180,081	1,5	3	k6			**1,040,910**	
341,804	1,5	3	k7			1,430,158	1,500,000
182,253	1,5	3	k8				**1,044,419**
213,480	1,5	3	k9				1,156,098
104,406	1,5	3	k10				
1,149,065	1,5	3	k11				
607,371	1,5	3	k12				
Min				**954,011**	**910,833**	**1,040,910**	**1,044,419**

Demand (Kg)	OC (Juta Rp)	HC (Rp)	Periode	Pemesanan 5 (Rp)	Pemesanan 6 (Rp)	Pemesanan 7 (Rp)	Pemesanan 8 (Rp)
163,874	1,5	3	k1				
126,288	1,5	3	k2				
168,071	1,5	3	k3				
99,560	1,5	3	k4				
146,692	1,5	3	k5				
180,081	1,5	3	k6				
341,804	1,5	3	k7				
182,253	1,5	3	k8				
213,480	1,5	3	k9	1,500,000			
104,406	1,5	3	k10	**918,662**			
1,149,065	1,5	3	k11	3,087,434	**1,500,000**		
607,371	1,5	3	k12		1,731,171	**1,500,000**	
Min				**918,662**	**1,500,000**	**1,500,000**	

Periode	Demand (Kg)	HC (Rp/Kg)	OC (Rp)	Penyimpanan (Bulan)	Pembanding	Hasil (Rp)
1	163,874	3	1,500,000	0	1	1,500,000
1-2	126,288	3	1,500,000	1	2	**954,011**
1-3	168,071	3	1,500,000	1	2	998018
3	168,071	3	1,500,000	0	1	1,500,000
3-4	99,560	3	1,500,000	1	2	**910,833**
3-5	146,692	3	1,500,000	2	3	923,185
5	146,692	3	1,500,000	0	1	1,500,000
5-6	180,081	3	1,500,000	1	2	**1,040,910**
5-7	341,804	3	1,500,000	2	3	1,430,158
7	341,804	3	1,500,000	0	1	1,500,000
7-8	182,253	3	1,500,000	1	2	**1,044,419**
7-9	213,480	3	1,500,000	2	3	1,156,098
9	213,480	3	1,500,000	0	1	1,500,000
9-10	104,406	3	1,500,000	1	2	**918,662**
9-11	1,149,065	3	1,500,000	2	3	3,087,434
11	1,149,065	3	1,500,000	0	1	**1,500,000**
11-12	607,371	3	1,500,000	1	2	1,731,171
12	607,371	3	1,500,000	0	1	**1,500,000**

Lampiran 10 Hasil Perhitungan *lot sizing* menggunakan Wagner Within *Algorithm* GBB Panaikang I

Periode	1	2	3	4	5	6
1	1.500.000	2.752.406	3.475.649	4.517.735	5.450.280	6.189.951
2		1.500.000	1.861.622	2.556.346	3.255.754	3.847.491
3			1.500.000	1.847.362	2.313.634	2.757.437
4				1.500.000	1.733.136	2.029.005
5					1.500.000	1.647.934
6						1.500.000
7						
8						
9						
10						
11						
12						

Periode	7	8	9	10	11	12
1	17.276.581	54.480.362	68.042.183	106.589.085	121.905.108	143.446.660
2	13.086.350	44.975.305	56.841.898	91.105.811	104.890.231	124.473.461
3	10.148.524	36.722.653	46.894.019	76.874.942	89.127.761	106.752.667
4	7.572.320	28.831.623	37.307.761	63.005.696	73.726.912	89.393.495
5	5.343.478	21.287.955	28.068.866	49.483.811	58.673.425	72.381.685
6	3.347.772	13.977.423	19.063.106	36.195.063	43.853.074	55.603.012
7	1.500.000	6.814.826	10.205.281	23.054.248	29.180.658	38.972.272
8		1.500.000	3.195.228	11.761.206	16.356.013	24.189.304
9			1.500.000	5.782.989	8.846.194	14.721.162
10				1.500.000	3.031.602	6.948.248
11					1.500.000	3.458.323
12						1500000

Periode	1	2	3	4	5	6
1	**1.500.000**	**2.752.406**	3.475.649	4.517.735	5.450.280	6.189.951
2		3.000.000	**3.361.622**	**4.056.346**	**4.755.754**	**5.347.491**
3			4.252.406	4.599.768	5.066.040	5.509.843
4				4.861.622	5.094.758	5.390.626
5					5.556.346	5.704.280
6						6.255.754
7						
8						
9						
10						
11						
12						
Min	**1.500.000**	**2.752.406**	**3.361.622**	**4.056.346**	**4.755.754**	**5.347.491**

Periode	7	8	9	10	11	12
1	17.276.581	54.480.362	68.042.183	106.589.085	121.905.108	143.446.660
2	14.586.350	46.475.305	58.341.898	92.605.811	106.390.231	125.973.461
3	12.900.930	39.475.059	49.646.424	79.627.348	91.880.167	109.505.073
4	10.933.941	32.193.245	40.669.383	66.367.317	77.088.533	92.755.117
5	9.399.823	25.344.301	32.125.211	53.540.157	62.729.771	76.438.031
6	8.103.526	18.733.178	23.818.860	40.950.817	48.608.828	60.358.766
7	**6.847.491**	12.162.317	15.552.772	28.401.740	34.528.149	44.319.763
8		**8.347.491**	10.042.719	18.608.697	23.203.504	31.036.796
9			**9.847.491**	14.130.480	17.193.685	23.068.654
10				**11.542.719**	13.074.321	16.990.967
11					**13.042.719**	15.001.042
12						**14.542.719**
Min	**6.847.491**	**8.347.491**	**9.847.491**	**11.542.719**	**13.042.719**	**14.542.719**

Lampiran 11 Hasil Perhitungan *lot sizing* menggunakan Wagner Within *Algorithm* GBM Panaikang II

Periode	1	2	3	4	5	6
1	1,500,000	1,908,020	2,994,052	3,959,051	5,854,833	8,763,924
2		1,500,000	2,043,016	2,686,349	4,108,185	6,435,458
3			1,500,000	1,821,666	2,769,557	4,515,012
4				1,500,000	1,973,945	3,137,582
5					1,500,000	2,081,818
6						1,500,000
7						
8						
9						
10						
11						
12						

Periode	7	8	9	10	11	12
1	15,389,887	19,511,739	25,029,565	28,065,472	65,190,384	86,776,157
2	11,957,094	15,490,110	20,318,207	23,016,792	56,429,212	76,052,642
3	8,932,321	11,876,500	16,014,870	18,376,132	48,076,060	65,737,148
4	6,450,564	8,805,907	12,254,548	14,278,487	40,265,925	55,964,669
5	4,290,473	6,056,980	8,815,893	10,502,509	32,777,455	46,513,857
6	2,604,327	3,781,999	5,851,184	7,200,476	25,762,932	37,536,990
7	1,500,000	2,088,836	3,468,292	4,480,262	19,330,226	29,141,941
8		1,500,000	2,189,728	2,864,374	14,001,848	21,851,220
9			1,500,000	1,837,323	9,262,305	15,149,334
10				1,500,000	5,212,491	9,137,177
11					1,500,000	3,462,343
12						1,500,000

Periode	1	2	3	4	5	6
1	**1,500,000**	**1,908,020**	**2,994,052**	3,959,051	5,854,833	8,763,924
2		3,000,000	3,543,016	4,186,349	5,608,185	7,935,458
3			3,408,020	**3,729,686**	**4,677,577**	6,423,032
4				4,494,052	4,967,997	6,131,634
5					5,229,686	**5,811,504**
6						6,177,577
7						
8						
9						
10						
11						
12						
Min	**1,500,000**	**1,908,020**	**2,994,052**	**3,729,686**	**4,677,577**	**5,811,504**

Periode	7	8	9	10	11	12
1	15,389,887	19,511,739	25,029,565	28,065,472	65,190,384	86,776,157
2	13,457,094	16,990,110	21,818,207	24,516,792	57,929,212	77,552,642
3	10,840,341	13,784,520	17,922,890	20,284,151	49,984,080	67,645,167
4	9,444,615	11,799,959	15,248,600	17,272,539	43,259,976	58,958,721
5	8,020,159	9,786,667	12,545,580	14,232,195	36,507,142	50,243,543
6	**7,281,904**	8,459,576	10,528,761	11,878,053	30,440,509	42,214,567
7	7,311,504	**7,900,340**	**9,279,797**	10,291,766	25,141,731	34,953,446
8		8,781,904	9,471,632	10,146,279	21,283,752	29,133,124
9			9,400,340	**9,737,663**	17,162,646	23,049,675
10				10,779,797	14,492,288	18,416,974
11					**11,237,663**	13,200,006
12						**12,737,663**
Min	**7,281,904**	**7,900,340**	**9,279,797**	**9,737,663**	**11,237,663**	**12,737,663**

Lampiran 12 Jumlah kendaraan per sekali pesan untuk perhitungan *total inventory cost* menggunakan metode *lot sizing*

1. Silver meal *heuristic* GBB Panaikang I

Pesanan Ke	Jumlah Pesanan	Kapasitas Kendaraan	Pesanan Perkendaraan	Pembulatan
1	832.588	20.000	41,6294	42
2	644.147	20.000	32,20735	33
3	1.852.788	20.000	92,6394	93
4	590.969	20.000	29,54845	30
5	1.493.082	20.000	74,6541	75
6	533.928	20.000	26,6964	27
7	682.686	20.000	34,1343	35
		Total		**335**

2. Silver meal *heuristic* GBM Panaikang II

Pesanan Ke	Jumlah Pesanan	Kapasitas Kendaraan	Pesanan Perkendaraan	Pembulatan
1	290.162	20.000	14,5081	15
2	267.631	20.000	13,38155	14
3	326.773	20.000	16,33865	17
4	524.057	20.000	26,20285	27
5	317.886	20.000	15,8943	16
6	1.149.065	20.000	57,45325	58
7	607.371	20.000	30,36855	31
		Total		**89**

3. Wagner Within *Algorithm* GBM Panaikang I

Pesanan Ke	Jumlah Pesanan	Kapasitas Kendaraan	Pesanan Perkendaraan	Pembulatan
1	452.587	20.000	22,62935	23
2	380.001	20.000	19,00005	20
3	644.147	20.000	32,20735	33
4	1.852.788	20.000	92,6394	93
5	590.969	20.000	29,54845	30
6	1.493.082	20.000	74,6541	75
7	533.928	20.000	26,6964	27
8	682.686	20.000	34,1343	35
		Total		**336**

4. Wagner Within *Algorithm* GBM Panaikang II

Pesanan Ke	Jumlah Pesanan	Kapasitas Kendaraan	Pesanan Perkendaraan	Pembulatan
1	16.846	20.000	0,8423	1
2	799.387	20.000	39,96935	40
3	545.859	20.000	27,29295	28
4	2.354.986	20.000	117,7493	118
5	1.580.423	20.000	79,02115	80
6	612.525	20.000	30,62625	31
7	708.397	20.000	35,41985	36
		Total		**334**