







Improved Extrusion Efficiency Through Data Driven Recommendations

An end-to-end solution for Aluminum production optimization

Angelos Charalambous, IT Director Savvas Bogatinis, Extrusion Manager ETEM Gestamp Extrusions



ETEM Gestamp Extrusions : Current landscape and Innovation journey

- ETEM Gestamp Extrusions runs several aluminum production lines producing architectural, automotive and industrial profiles. The lines have a high throughput, quality and availability requirements.
- Improvement areas:







Production speed

Scrap

Energy Costs

Data driven Insights



• SAP solutions support our digital transformation





Improve Extrusion Efficiency through Data Driven Recommendations

Productivity Rate:

Develop measure to assess operational setup efficiency



Recipe Best Run Detection:

Identify best (in terms of productivity) recipes for known profiles



ETEM

Recipe Recommendation:

Identify efficient operational settings for new profiles



Gestamp

Easy reporting, analytics and predictive capabilities:

- Assess the effect on productivity when operational settings are adjusted (e.g. to the manufacturer limits)
- Get insights in the form of a meaningful report



Data and Data Sources



Data Unification (single point of truth):

Establishing a unified view across different data sources and use advanced analytics tools & methodologies for insights extraction



ETEM Gestamp

Production line settings efficiency



Productivity Rate "on-the-fly" computation:

Combine various production performance metrics to quantify in real-time the effectiveness of production line settings

Performance indicators summarized within productivity rate:



** Abnormal scrap rates and outlying values are discarded from the data. Only extrusions with >10 billets per extrusion and scrap rate between [10 -30%] were preserved



• Optimizing for existing profiles



I≡

Recipe "Best-Run" Detection:

Analyze millions of records in real-time on top of the unified data across all data sources to retrieve the operational settings which have historically led to optimal production (as indicated per the computed productivity rate)

Profile	Extrusion ID	Puller Speed	Billet Temperature	Exit Temperature	Peak Pressure	Puller Force	Scrap Rate	Productivity Rate
29346	28911	23,5	452,467	569 , 267	255,033	33,333	11,78	1.978,53
29346	28916	21,7	474,55	563,25	252,275	36,425	22,6	1.548,24
29346	28929	21,833	466,833	570,205	254,115	39,538	16,38	1.771,34
29346	29705	21,81	466,025	568,506	252,177	30,063	13,81	1.732,03
29346	29720	19,333	471,444	567,667	249,333	29,333	18,85	1.515,15
29346	29722	20,111	460	568,667	257,667	28	14,75	1.622,35
29346	29731	18,862	470,138	570,345	255,586	30	20,66	1.396,9
29346	30667	24,067	459,067	576,467	253,6	30	27,94	1.624,13
29346	30693	20,838	458,231	578,846	255,658	33,068	11,75	1.708,48
29346	30695	22,667	468,333	573,778	243,222	32	18,35	1.748,88
29346	30700	19,633	455,067	573,233	256,133	32	14,3	1.597,7
29346	30990	19,5	472,5	568,125	245,5	40	18,61	1.477,34
29346	31001	22,017	456,068	572,288	255,814	38,356	13,14	1.814,49
29346	31993	20,48	459,32	558,48	259,6	35	21,01	1.874,82
29346	31995	20	463,667	566,667	257,333	37	17,11	1.573,52
29346	31999	19,364	455,114	556,273	258,545	35,045	21,82	1.397,59
29346	32005	18,894	458,043	554,064	257,426	29,596	12,34	1.536,97
29346	32028	20,694	465,245	564,49	259,245	36,429	20,25	1.524,41

Recipe Parameters:

- Puller speed
- Billet temperature
- Exit temperature
- Peak (max) stem pressure
- Puller force

Recipe "Best-Run" Detection

PROFILE E-55755 MULTI 4 20 **BILLET PIECES** ALLOY 6060

PRODUCTIVITY RATE

DIE_MULTI: 4



BILLET_EXT_PRESS: (All)

BILLET_PCS: >= 20

EXTRUSION_DIE_STATUS: (All)

SCRAP_PERC: between 10 and 30

Model_for_Productivity_Rate <pre>@ {}</pre>													
					MEASURES	PULLER_SPEED	TEMPERATURE	EXIT_TEMPERATURE	PEAK_PRESSURE	PULLER_FORCE	BILLET_PCS	SCRAP_PERC	PRODUCTIVITY_RATE
BILLET_EXTRUSION	DIE_MULTI	ALLOY	EXTRUSION_DIESTATUS	PROD_RNK	PROFILE								
Breda	4	6060	ок	1	E-55755	19.314285	468.800000	-	245.514285	58.571428	35.000000	13.42	1,026.080000
Breda	4	6060	ок	2	E-55755	19.055555	470.111111	_	248.750000	61.694444	35.000000	21.61	1,017.010000
Breda	4	6060	ок	3	E-55755	16.718309	470.422535	-	228.521126	63.985915	70.000000	14.56	933.420000
Breda	4	6060	ок	4	E-55755	17.466666	471.600000	_	224.300000	56.066666	30.00000	18.42	916.750000
o da	4	6060	ок	5	E-55755	16.510869	467.728260	-	237.967391	66.782608	92.000000	13.62	916.030000
Breda	4	6060	ок	6	E-55755	15.367924	475.603773		238.801886	66.481132	105.000000	12.08	908.260000
Breda	4	6060	ок	7	E-55755	15.926229	478,795081		229.991803	66.991803	122.000000	15.41	906.370000
Breda	4	6060	ок	8	E-55755	15.500000	492.259259		233.777777	66.462962	53.000000	12.46	901.00000
Breda	4	6060	ок	9	E-55755	16.406250	469.687500	_	244.812500	56.203125	64.000000	13.25	895.260000
Breda	4	6060	ок	10	E-55755	15.675000	477.725000	_	238.150000	56.725000	40.000000	12.36	885.480000



Optimizing for new profiles



Ļ

Recipe Recommendation:

A new order is received to produce a profile which was never produced before.

- What settings could yield near-optimal production performance?
- How to avoid trial-and-error? Reduce scrap?



New customer



Data need to be analyzed to I im identify efficient production settings

Time, cost and quality need to be factored in



ETEM Gestamp 🖉

Optimizing for new profiles



How it works:

Employ "HANA PAL functions" (kNN lazy learnier) to compute similarity of a new profile to all existing ones in terms of known profile characteristics. Suggest the best performing recipes corresponding to the closest resembling profiles for which data are available

- Leverage information from architectural characteristics of existing profiles
- Identify then closest profiles for which recipes are available to infer new recipe

Exp	planatory Va	riables (pro	ofile specs)	Target	
Min Thickness	Total perimeter	Extrusion Ratio	Weight/ meter	 Recipe ID	
1.54	154.8	50	1.3	5	
1.58	1458	52	1.3	3	
1.55	1300	55	1.4	2	
1.56	145.6	58	1.4	12	
1.55	146.0	51	1.3	8	
1.50	165.4	60	1.5	5	1
1 50	145 9	51	2437	?	

	Recipe										
ID	Extr. Temp	Extrusion Time	Base Pressure								
5	494	159	159								
3	490	159	160								
2	499	167	118								
12	490	170	111								
8	490	159	160								
5	447	160	167								
		1									
1000	490	159	160								

Recipe Recommendation

TYPE	Industrial	PRESS	Breda	ALLOY	6060	WEIGHT_PER_METER	498	TOTAL_PERIMETER	189	kNN	10
MULTI	2	PORTHOLE	FLAT	R_COEFF	67	MIN_THICK	2	CIRCUM_DIAM	67		



F

					MEASURES	DISTANCE	AVG_BILLET_PULLERSPEED	AVG_BILLET_BILLETTEMPERATURE	AVG_BILLET_EXITTEMPERATU	AVG_BILLET_PEAKPRESSURE	AVG_BILLET_PULLERFORCE	SCRAP_PERC	PRODUCTIVITY_RATE
к	EXTRUSION_ALLOY	EXTRUSION_DIESTATUS	EXTRUSION_BILLETPCS	EXTRUSION_DIEMULTI	MATCHED_PROFIL_NUMBER								
1	6060	ОК	14	2	34714	2,45	15.857142	471.214285		165.142857	18.500000	23.379999	717.010000
2	6060	ок	15	2	9162	4.22	25.733333	445.600000	(m.	205.533333	61.800000	16.079999	1,422.860000
3	6060	ок	17	2	4127	4.23	26.705882	445.529411	-	205.470588	52.294117	12.669999	1,339.760000
4	6060	ок	13	2	9046	4.28	21.230769	447.769230	(m.	192.230769	51.153846	14.359999	1,204.520000
5	6060	ок	18	2	17017	5.30	13.555555	466.111111	9	183.055555	73.277777	19.890000	710.940000
6	6060	ок	37	2	34703	6.47	21.405405	455.540540	-	199.783783	56.648648	11.830000	1,159.710000
7	6060	ок	17	2	4216	6.56	22.000000	473.055555	10	174.11111	20.944444	13.570000	1,141.710000
8	6060	ок	14	2	34203	7.21	22.857142	462.214285	-	186.928571	51.142857	10.359999	1,235.880000
9	6060	ок	14	2	4102	7.44	29.500000	445.785714		209.928571	51.714285	10.929999	1,690.580000
10	6060	ОК	14	2	5100	8.53	30.142857	440.357142		197.714285	39.642857	10.480000	1,518.130000

Advanced Analytics and Operational Simulation



Ļ

Advanced Analytics for the Citizen Data Scientist:

Employ SAP Analytics Cloud (SAC) smart discovery to obtain meaningful reports on top of the collected data.





Analyze **PRODUCTIVITY_RATE** by **EXTRUSION_ALLOY**.



Unable to find Smart Insights for this measure



Advanced Analytics and Operational Simulation



Operational Simulation:

Employ SAP Analytics Cloud (SAC) smart discovery to quantify contribution of each operational setting to productivity rate. Use what-if analysis to compute impact of new settings to productivity



The digital transformation yields tangible business benefits

Best Run Detection Service:

- Significant reduction in requested resources to identify the best run
- Management tool supports rational continuous improvement
- Reduction in severe mistakes while updating recipes
- Reduction in "Knock-Offs" and quality defects during production

Recipe recommendation for new incoming profiles:

- Direct successful incorporation of new products based on best recipes of existing profiles
- Important cost and "loss" productivity reduction for all new incoming products

Operational Simulation

- Non negotiable annual improvement plans
- Drastic acceleration of plant's productivity improvement
- Increase in reliability of annual production budgets
- Improvement in logical decisions for updating recipe rate & design by product

Advanced Analytics and Reporting

• Considering replacing all existing solutions for analytics, BI and reporting to SAP Analytics Cloud







→ more than €120,000/year



invaluable

ETEM Gestamp

Analytics and Reporting as an End to End Process



Ē

Summary



Artificial Intelligence can improve business processes



ETEM Gestamp Extrusions can optimize existing recipes for known profiles and generate effective recipes for new profiles



ETEM Gestamp Extrusions determined that it is possible to simulate and improve productivity rates for new operational settings



ETEM Gestamp Extrusions identified that there is scope to replace existing analytics and reporting tools with SAP Analytics Cloud IF WE HAVE DATA, LET'S LOOK AT DATA. IF ALL WE HAVE ARE OPINIONS, LET'S GO WITH MINE.

Jim Barksdale, former CEO of Netscape Communications Corporation



Thank you!

Angelos Charalambous, IT Director Savvas Bogatinis, Extrusion Manager ETEM Gestamp Extrusions

