Amazon Innovation Award 2021 – Going Green case

1 Executive Summary

Thanks for participating to the Amazon Innovation Award!

For this competition you will be the Head of Delivery Service for Amazon Logistics, the last mile branch of Amazon, committed to deliver to the Customer their shipment in high density area for one south-European country.

One early morning, you are meeting with your boss for your weekly 1:1, the Country Director of Amazon Logistics, Gabriele. Gabriele communicates you we need to get serious on the Climate Pledge for last mile in Italy. After an in-depth discussion you agree that one of the cities you serve will act as a "laboratory" and will use to experiment a full-scale carbon-free delivery. You agree to present to the VP-Europe in 3 weeks. Going back to your office, you are thinking that a suitable location would be a new delivery station located in Varese.

2 Amazon Last Mile

As you probably already know, "Last mile" is a term used in supply chain management and transportation planning to describe the movement of people and goods from a transportation hub to a final destination – for us this is to our customer. The heart of the Amazon Last Mile network is represented by the Amazon Logistics Delivery Stations.

Amazon currently operates 25 Delivery Stations in Italy but to understand how it all works, let's take a little step back. When a customer order is received, the order is picked from an Amazon Fulfilment Centre, packed and labelled and sorted with other parcels that are going to be delivered by local and regional transporters to an Amazon Logistics sort center, where it is sorted to be sent to a Delivery Station. This is where we enter the "Last Mile".

At the Delivery Station, the parcels are sorted and combined by our Associates with other deliveries for similar postcodes (routes). The parcels are then collected by Delivery Associates from local and regional carriers, who delivers the parcel directly to the customer. By enabling regional carriers to deliver customer orders from Amazon, six days a week, Amazon Logistics adds capacity and flexibility to Amazon's delivery network. Carriers range from small companies to larger businesses.

3 Climate pledge

Amazon is committed to building a sustainable business for our customers and the planet. In 2019, Amazon co-founded The Climate Pledge—a commitment of all its signatories to be net zero carbon across our business by 2040, 10 years ahead of the Paris Agreement. Companies that sign The Climate Pledge agree to: measure and report greenhouse gas emissions on a regular basis; implement de-carbonization strategies in line with the Paris Agreement through real business changes and innovations, including efficiency improvements, renewable energy, materials reductions, and other carbon emission elimination strategies.

For the Amazon last mile, our routing technology maximizes efficiency on road for drivers. It also learns and gets smarter every day, meaning we can get better at delivering an item to a customer the first time. As an example, when we know the opening times of a business that has ordered an item, we will not try to deliver it if we know no one is there. A successful first attempt means we don't have to try again. It means happier customers, fewer vans and fewer trips - which is also better for our business.

Also, recently Amazon announced the order of 100,000 electric delivery vehicles from Rivian, the largest order ever of electric delivery vehicles, with vans starting to deliver packages to customers soon. Amazon plans to have 10,000 of the new electric vehicles on the road as early as 2022 and all 100,000 vehicles on the road globally by 2030 – saving millions of metric tons of carbon per year by 2030. Across Europe, our delivery fleet is already comprised of thousands of low-pollution electric and natural gas vans and cars, and we are using e-cargo bikes for deliveries in some urban centers. As part of new building designs, Amazon is providing electric charging stations for delivery vehicles for our partners as well as associates. Amazon has thousands of charging stations at our facilities for our partners to use, with plans to add thousands more in the coming years to support sustainable deliveries.

4 How to solve it?

Amazon is willing to experiment alternative transportation methods (walker, electric motorcycles, electric vehicles of different capabilities). Those deliveries are performed using plants "Delivery Stations" capable to sort the customer deliveries into routes. Additional buildings/structures might be built in a city. It is up to your choice to conceive a system where packages originate from the delivery station and get to the customer, carbon free their shipments. The delivery

station does not hold any stock, only customer shipments. Shipments are received by truck in the delivery station during the night (typically between 22:00 and 02:00) and need to be delivered by 22:00 of the following day (e.g.: a parcel received by the Delivery Station in the truck arriving at 23:00 on March 23rd need to be delivered to the customer by March 24th). **All** the shipments need to be attempted: you work at Amazon, Customers are waiting for their orders.

You are equipped with a technology that is able to optimize how shipments are routed: if you give this technology a capacity of the vehicle, the duration of the route, the number of vehicles and the starting point, this algorithm it is able to select the parcels to deliver, group and assign them to the vehicle. You are **not** tasked to modify this algorithm: just assumes it is a "black box" that you can use. On the other hand, you **are** tasked to provide realistic assumption on the inputs for this algorithm (where vehicles start, how many, of which kind, for how many hours).

Delivery stations are capable to sort parcels and prepare routes over the night. They can also prepare routes that will be physically dispatched from other locations. In this case, you need to think how routes will get from the delivery station to the dispatch location (trucks, small/big trucks…)

Please support your choices with financial estimates. The numbers stated below are just a guidance.

4.1 High level hypothesis[1]

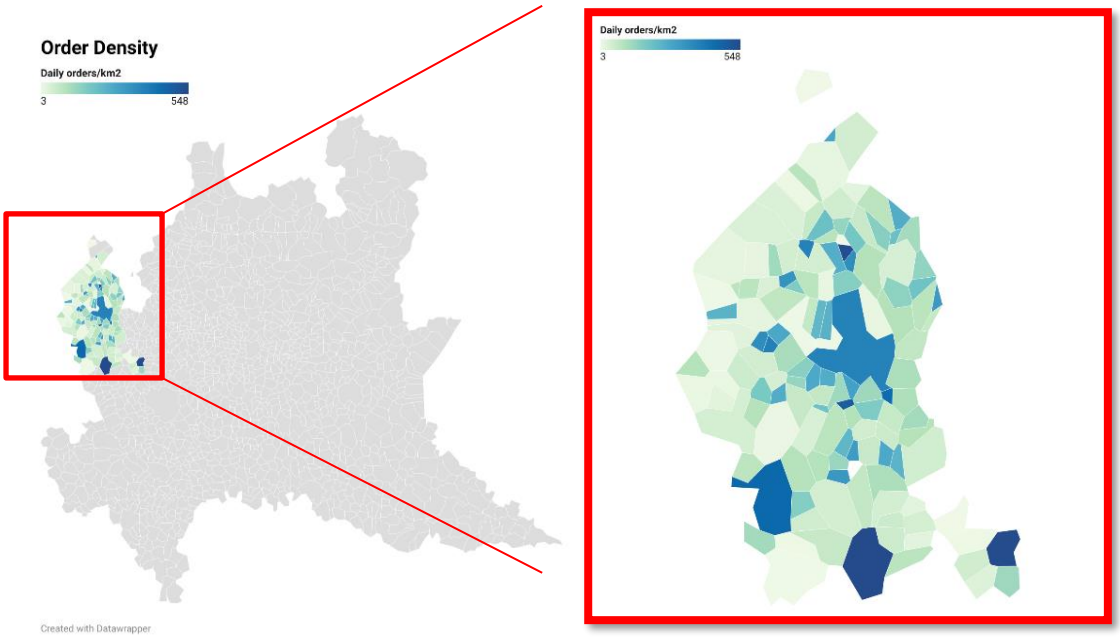
Varese delivery station has a capacity for 140.000 packages to be delivered every day. Consider a possible weekly fluctuation (we do not ship every day the exact same number of parcels) of about +/- 15%. The delivery station is equipped with large parking, where you can fit electric chargers. The station has also space to park/move trucks. The station is located in 45°44'29"N 8°53'12"E.

The Delivery Associate (the person driving the vehicle/walking) cost is assumed of 190€/day for an 8:45hrs shift. You can hire part-timers at 4hrs/6hours. Assume the cost varies pro quota. You can assume the start of shift can occur at any time of the day. Delivery Associates start and end their work at the same locations. Undelivered parcels (wrong address/Customer unavailable/Package refused…) need to be retaken at the start location and then back at the Delivery Station.

Capacity of a vehicle:

- 250 (large van)
- 140 (small van)
- 20 (motorcycle)[2]
- 10 (walker)

The density of the parcels to be delivered by area are as follows:



[1] The data included in this section is completely fictitious and created for the sole purpose of this challenge

[2] Assume the package fit the motorbike/walker

Full data in Appendix.

Research endurance/range/speed of a vehicle using manufacturer specification.

The number of packages that can be delivered per hour (SPH – shipments per hour) depends on the density of the orders in the specific area, maxing at 20 parcels/hour in areas with over 500 parcels/km2.

Research any other method of transportation or structure/building you deem necessary. Consider the transportation mean between each building as well. Make the hypothesis you need (real-estate cost, public transportation, roads…), based on the specific geography you have. Be creative!

5 Goals

Identify the different possible solution to deliver in the mapped area, with the lowest carbon emissions, what shall be the mix of vehicles, the additional structures (parking, small warehouses needed). Deliver all the parcels within one day, at the lowest possible cost.

Identify the most critical areas to deliver and propose possible mitigation

5.1 Success criteria

Carbon emissions vs performing the same deliveries with large internal combustion vans

Implementation cost and operative cost.

Safety impact, ergonomic impact,

Guaranteed you have made at least one delivery attempt. Spend the least amount operative cost of money

How real were the hypothesis/approximations you made.

6 How you will present it

You will present it the Amazon way, so you will write a six-pager memo. You also have to include as “page zero” a Press Release as first thing. In Amazon we start from the Customer and then work backwards: the first thing to think about is “how will the customer think about this”, how will this appear as an article on the first page of a national newspaper. Then you have additional 6 pages to present your idea: focus on that is relevant, give us a crisp description of your idea. You can put the additional data in appendixes.

Or, as Jeff Bezos said: *“The traditional kind of corporate meeting starts with a presentation. Somebody gets up in front of the room and presents with a PowerPoint presentation, some type of slide show. In our view you get very little information, you get bullet points. This is easy for the presenter, but difficult for the audience. And so instead, all of our meetings are structured around a 6-page narrative memo.... If you have a traditional ppt presentation, executives interrupt. If you read the whole 6-page memo, on page 2 you have a question but on page 4 that question is answered.”*

You will write a 6 pager (Calibri 10) with additional appendixes/FAQs. Your ability to present a crispy summary of your idea will be integral part of your evaluation. Typical structure of a six-pager:

- Purpose of the document: A concise statement of the reason for the narrative, summary recommendation, and immediate action required.
- Tenets, or guiding principles, for the department, team, or project. (If you prefer, place the tenets in an appendix instead of in the main body of the document)
- The details of the situation being addressed.
- The recommendation for resolving the situation.
- The implementation plan for the recommended solution. This typically includes the scope, schedule, staffing, and costs.
- A set of appendices, such as a list of contributors, a press release, a FAQ, and supporting documents and data.

6.1 Must haves

- Is no more than six pages long. The author can provide as much supporting data as needed in an appendix, but there is no guarantee that anyone will read the appendices accompanying a narrative. It is not recommended to move text into an appendix that must be read for the narrative to make sense. The appendices are there for reference only.
- (Ideally) Starts with the tenets of the area. These remind the narrative reader of the core mission of the team or the guiding principles for the project discussed in the narrative.

- Clearly states the objective or purpose in the first paragraph. Purpose statements are concise and provide the reader with a clear reason for the narrative, whether it is for decision-making, information sharing, a project update, or something else about the topic area.
- Makes a recommendation early in the document. Have an upfront summary of your recommendations. Not everyone will have time to read the entire document, so help them understand your recommendation and reasoning early in the narrative.
- Calls out the next steps at the end. Your final document should be the actionable long-term vision with big ideas, not a summary of what you did during the project. The recommendations should be supported by data that cover the deliverables in the short, medium, and long-term. Consider the risks and alternatives, but present your recommendations of the best path forward with a clear roadmap for next steps.

The above requirements might seem a little odd but they have helped enforce a highly effective mechanism that drives upfront thinking, clarity and precision of thought, and alignment with the thought process.

7. Timing

Here below you can find a recap of the various deadlines and appointments to help you plan the work with your team.

- **April 14th:** deadline to sign-up to the contest and create your team, following your University's guidelines. The teams can consist of a minimum of 3 to a maximum of 5 students.
- **April 16th – April 23rd**: Participate to virtual Fulfillment Center Tours to learn how our Fulfillment Centers work from the inside. Virtual tour dates options will be communicated
- **April 26th – April 30th**: first Q&A session with Amazon Logistics managers
- **May 17th – May 21st**: second Q&A session with Amazon Logistics managers
- **June 28th**: deadline for six-pager submission to your University. The University will provide you with more details on how to submit your paper
- **September 2021**: awards ceremony

8. Amazon Innovation Award 2021 sign-up process

Politecnico Milano:

Reach out to University point of contact: Prof. Riccardo Mangiaracina

Università di Roma Tor Vergata

Follow the steps on moodle.ing.uniroma2.it

University point of contact: Prof. Massimiliano Schiraldi

Politecnico di Bari:

Follow the steps on http://www.poliba.it/it/placement/amazon-innovation-award-2021

University point of contact: Prof. Antonio Messeni Petruzzelli

This is your first Day 1 at Amazon, welcome onboard and good luck!

7 Appendix 1 – Typical delivery volume by town

Town	Population Residents	Surface km²	Population Density residents/km²	Altitudine m s.l.m.	Order Share %	Daily Orders Orders	Order density orders/km²
VARESE	80,724	54.84	1472	382	15.00%	21,000	383
Busto Arsizio	83,679	30.66	2729	226	12.00%	16,800	548
Somma Lombardo	17,561	30.51	576	282	10.00%	14,000	459
Lonate Pozzolo	11,506	29.24	394	205	0.08%	115	4
Sesto Calende	11,105	25.04	443	198	0.80%	1,115	45
Laveno-Mombello	8,566	23.53	364	205	0.32%	454	19
Vergiate	866	21.78	40	270	0.17%	234	11
Tradate	18,727	21.48	872	303	0.77%	1,077	50
Luino	14,387	21.01	685	202	0.26%	358	17
Gallarate	54,207	20.98	2584	238	0.71%	996	47
Castelveccana	1,938	20.79	93	257	0.56%	791	38
Dumenza	146	18.4	8	411	0.67%	932	51
Angera	5,428	17.72	306	205	0.15%	208	12
Porto Valtravaglia	2,298	16.37	140	199	0.43%	604	37
Cuasso al Monte	3,543	16.18	219	530	0.49%	692	43
Samarate	16,057	16.01	1003	221	0.77%	1,083	68
Ispra	525	15.91	33	220	0.10%	147	9
Besozzo	8,834	13.95	633	258	0.21%	298	21
Leggiuno	3,716	13.19	282	240	0.05%	73	6
Valganna	1,563	12.42	126	460	0.86%	1,197	96
Induno Olona	10,318	12.37	834	394	0.13%	186	15
Cassano Magnago	21,416	12.34	1735	261	0.64%	894	72
Mornago	4,948	12.24	404	281	0.36%	505	41
Arcisate	9,948	12.13	820	381	0.83%	1,169	96
Gavirate	9,223	12.01	768	261	0.06%	77	6
Sumirago	6,099	11.75	519	392	0.73%	1,025	87
Cairate	7,663	11.26	681	273	0.86%	1,204	107
Cislago	10,247	11.13	921	237	0.03%	37	3
Cittiglio	3,811	11.11	343	254	0.14%	197	18
Tronzano Lago Maggiore	219	11.06	20	342	0.03%	36	3
Saronno	38,785	11.06	3507	212	4.30%	6,020	544
Uboldo	10,613	10.74	988	205	0.41%	569	53
Casale Litta	2,709	10.59	256	382	0.51%	719	68
Arsago Seprio	4,805	10.51	457	290	0.69%	972	92
Cadegliano-Viconago	2,143	10.27	209	414	0.62%	868	85
Montegrino Valtravaglia	1,475	10.1	146	525	0.38%	537	53
Brezzo di Bedero	12	9.95	1	352	0.07%	98	10
Cocquio-Trevisago	4,692	9.81	478	291	0.56%	778	79
Gerenzano	10,789	9.79	1102	226	0.05%	74	8
Travedona-Monate	4,044	9.6	421	273	0.35%	489	51
Biandronno	3,263	9.52	343	262	0.78%	1,089	114
Cardano al Campo	14,428	9.42	1532	240	0.35%	489	52
Viggiù	5,121	9.26	553	482	0.57%	796	86
Cantello	4,679	9.13	512	404	0.50%	696	76
Malnate	16,525	9	1836	355	0.70%	976	108
Fagnano Olona	12,363	8.68	1424	265	0.31%	427	49
Ferno	6,736	8.66	778	211	0.05%	69	8
Caronno Pertusella	17,973	8.4	2140	194	0.77%	1,085	129
Cadrezzate con Osmate	2,623	8.25	318	281	0.34%	481	58
Origgio	7,891	7.92	996	194	0.18%	253	32
Taino	3,638	7.63	477	262	0.13%	182	24
Vizzola Ticino	566	7.61	74	196	0.66%	920	121
Cuveglio	3,318	7.53	441	294	0.25%	357	47
Gorla Minore	8,218	7.48	1099	237	0.24%	341	46
Besnate	5,467	7.48	731	300	0.51%	712	95
Golasecca	2,609	7.44	351	280	0.45%	626	84
Casalzuigno	1,363	7.32	186	350	0.25%	355	49
Olgiate Olona	12,542	7.21	1740	239	0.30%	417	58
Vedano Olona	7,357	7.08	1039	360	0.53%	741	105
Bisuschio	4,344	7.03	618	345	0.76%	1,071	152
Castello Cabiaglio	554	6.98	79	514	0.07%	100	14

Castellanza	1,437	6.93	207	216	0.43%	605	87
Casorate Sempione	5,681	6.91	822	282	0.81%	1,138	165
Castiglione Olona	7,641	6.9	1107	307	0.33%	463	67
Brebbia	3,168	6.87	461	225	0.13%	186	27
Ranco	1,294	6.76	191	214	0.46%	643	95
Venegono Superiore	7,357	6.73	1093	331	0.58%	813	121
Cugliate-Fabiasco	3,018	6.54	461	516	0.30%	418	64
Brinzio	798	6.4	125	510	0.74%	1,039	162
Carnago	6,645	6.21	1070	354	0.28%	395	64
Brissago-Valtravaglia	1,206	6.12	197	429	0.28%	395	65
Cunardo	2,942	6.06	485	450	0.82%	1,141	188
Cuvio	1,668	5.96	280	309	0.37%	514	86
Brusimpiano	1,151	5.91	195	289	0.51%	711	120
Venegono Inferiore	6,039	5.88	1027	320	0.39%	548	93
Caronno Varesino	4,849	5.75	843	403	0.21%	293	51
Morazzone	4,243	5.6	758	432	0.69%	962	172
Comerio	2,873	5.55	518	382	0.28%	387	70
Marchirolo	3,483	5.49	634	500	0.63%	880	160
Mercallo	1,827	5.48	333	277	0.37%	518	94
Porto Ceresio	2,878	5.34	539	280	0.56%	782	146
Gorla Maggiore	4,954	5.16	960	258	0.09%	119	23
Caravate	2,563	5.13	500	296	0.32%	444	87
Solbiate Olona	5,414	4.93	1098	247	0.21%	294	60
Mesenzana	1,589	4.88	326	305	0.71%	991	203
Marnate	7,975	4.85	1644	227	0.08%	111	23
Gazzada Schianno	4,594	4.84	949	368	0.45%	623	129
Lonate Ceppino	5	4.84	1	287	0.83%	1,165	241
Gornate Olona	2,166	4.7	461	303	0.20%	286	61
Comabbio	1,189	4.69	254	307	0.60%	837	179
Ternate	2,561	4.68	547	281	0.15%	205	44
Germignaga	3,879	4.66	832	204	0.29%	408	88
Cremenaga	762	4.55	167	272	0.08%	112	25
Monvalle	1,909	4.54	420	226	0.80%	1,114	245
Azzate	4,648	4.51	1031	332	0.41%	578	128
Rancio Valcuvia	921	4.45	207	296	0.81%	1,128	254
Lavena Ponte Tresa	586	4.44	132	275	0.83%	1,161	261
Brenta	1,718	4.18	411	276	0.37%	520	124
Luvinate	1,323	4.07	325	425	0.72%	1,004	247
Casciago	3,679	4.05	908	426	0.02%	25	6
Bodio Lomnago	2,205	4.04	546	273	0.79%	1,099	272
Daverio	3,024	4.03	750	327	0.20%	283	70
Cazzago Brabbia	812	4	203	265	0.45%	636	159
Cassano Valcuvia	652	3.95	165	296	0.25%	348	88
Barasso	166	3.92	42	401	0.64%	901	230
Albizzate	5,222	3.88	1346	334	0.65%	904	233
Jerago con Orago	5,171	3.87	1336	324	0.38%	526	136
Castronno	5,063	3.76	1347	325	0.26%	370	98
Castelseprio	1,301	3.75	347	310	0.73%	1,019	272
Orino	804	3.72	216	456	0.45%	627	169
Gemonio	2,906	3.67	792	303	0.10%	136	37
Saltrio	3,062	3.44	890	543	0.77%	1,085	315
Besano	2,506	3.43	731	350	0.48%	670	195
Varano Borghi	2,438	3.33	732	281	0.62%	864	260
Cavaria con Premezzo	5,754	3.32	1733	268	0.76%	1,071	322
Galliate Lombardo	988	3.27	302	335	0.61%	855	262
Solbiate Arno	4,056	3.03	1339	325	0.67%	937	309
Clivio	1,905	2.98	639	468	0.15%	205	69
Agra	395	2.8	141	655	0.56%	787	281
Malgesso	1,255	2.77	453	291	0.69%	969	350
Bedero Valcuvia	654	2.56	255	520	0.64%	893	349
Bardello	1,605	2.52	637	263	0.50%	695	276
Buguggiate	3,096	2.5	1238	306	0.53%	735	294
Duno	123	2.49	49	530	0.68%	953	383
Inarzo	1,062	2.43	437	261	0.25%	346	142
Bregano	850	2.29	371	303	0.64%	893	390
Sangiano	148	2.22	67	223	0.13%	189	85

Azzio	755	2.17	348	399	0.52%	727	335
Grantola	1,229	2.05	600	250	0.21%	289	141
Marzio	316	1.86	170	728	0.27%	382	205
Masciago Primo	297	1.81	164	343	0.70%	977	540
Lozza	1,264	1.71	739	329	0.55%	766	448
Brunello	936	1.62	578	411	0.57%	798	493
Ferrera di Varese	687	1.53	449	299	0.00%	4	3
Crosio della Valle	604	1.44	419	322	0.21%	287	199

162