Meeting 2

Date	Tuesday, 19 January 2021
Attendees	Dr Ali Yetisen (AY), Marie Jones (MJ), Mathusan Kandiah (MK), Zong Lee (ZL), Yuxin Liu (YL), Mustafa Naser (MN), Helen Ogbobi (HO), Wei Ooi (WO), Andreas Richardson (AR), Stephen Tan (SN), Sathurthini Thurairatnam (ST), Mingchuan Zheng (MZ)
Apologies	None
Chair	Yuxin Liu (YL)
Secretary	Mingchuan Zheng (MZ)

Minutes

Item	Discussion
1 – Economics team update	AR: first consultation with David Edwards, turns out not much support on product selection and role is more logic checking; he comes with prices. Discussed economics, ideal to profit, but it could be that it's not profitable. Went through price information and contacted companies. Found info from India on bulk chemicals. MK: we should get table for price data so that comparisons are easier AY: facilitators and experts don't make decisions. Can't make customer or someone outside to give advice. Won't answer decision-making questions – will bounce back. Questions need to be general and common-sense. Better to have quantitative data before meetings. E.g., ask for range: do you think it's reasonable to produce at certain retail price. Frame questions such that they can answer constructively. Can request samples of business reports. Can have idea of market – don't trust single report and potentially take average. Eliminate reports that aren't reliable. Graphs help. Can produce data ourselves. Sometimes companies produce annual reports for investors. AR: challenge: too many products to delve in details.
2 – Selection of location	MN: 5 categories – supply chains, economics – tax and interests etc., political stability, operating cost, HSE. Switzerland good: good pharma industry already established, and is in Europe. Singapore, Qatar also good. When final products decided, locations can be decided conclusively. AY: Where are existing companies based? MN: a lot of pharma in Switzerland. AY: strategically good? (competition) MN: not too competitive; two competitors, but good incentive in Switzerland. AY: they produce feeds themselves?

	MN: yes AY: what makes them want to use our products as feedstocks? MN: differentiator by final products AY: rough estimate on company sales distribution AY: they may not want to switch supply chain if they have one even though price might be cheaper from us. More values we can offer: purity, delivery, protocols, etc. These barriers might be high. Different from consumer products. What are issues with current supply chain? Can try to address limitation in that. Must be a significant inventive.
3 - Present five possible products	**Aminobenzoic acid (AR, WO)** AR: sticking COOH on aminbenzen ring. Para is important and has markets in many industries. Can be used for pharma or agriculture etc. Challenge: conceptually nitro -> amino, but no paper yet on nitration. May be possible to negotiate if we can "skip" nitration. AY: sigma and merck sell on different prices. Can propose to experts. Explain problems or challenges with specific product lines. They will be flexible. AR: looked at the simplest compounds/intermediates. AY: isomers? AR: p important. Routes exist for others, but much less usage. AY: market shares for isomers? AR: haven't found specific info. For some end products, info exist. AY: in general, a lot of reports biased. Tend to bias towards NA. Try to derive some of our own conclusions. Some companies in the East don't publish reports. Some reports in non-English languages. **Aminobenzaldehyde (HO, MJ)** HO: 2 and 4 can get. 2 more useful (antimalaria e.g.). 4 can be used for polymers or pharma or dyes. Synthesis routes difficult. 2 prepared from 2-nitro (which is a side product by itself). Maybe not ideal for synthesis but include this in report, nonetheless. Paper on continuous process but yield bad. MJ: to get 2 or 4, need 2-4 nitro. However, 73 can be 3- when nitration. Oxidation of toluene can go into 2 or 4, but extra step. AY: who's doing business? YL: economics team

AY: what products would be important to produce at this stage. Will affect synthesis.

AR: 2- is a lot more expensive than p-benzoic, but because difficult

AY: HO team need to make decisions from economics team.

MK: how to account of process difficulty hence more expensive

AY: may be complicated, but how complicated compared to another line? Feed info to HO and MJ and ST. Repeat cycle until consensus. Feedback mechanism between teams.

Aminophenol (ST, ZL)
ST: researched especially on 4-. Nitration and hydrogenation. Usually nitrobenzene. Doesn't match with brief. Nitration of nitrophenol then lean towards 2. Not much kinetic data either.

AY: patent literature?

ST: most based on nitrobenzene.

AY: normally mention products want to achieve. How many patents at this point?

ST: patents on 2- as opposed to 4-. Some literature suggest not economically viable to produce 4- via nitration.

AY: some products may not be economically viable for synthesis route. Need innovation. Cut cost or new route. Ask why some products not viable and what to do to improve.

ST: literature use ionic liquid that doesn't have info.

AY: need to strengthen team. Recommend 2 or 3 spend more time to do research. Search using different keywords in different databases.

AR: scifinder good

Toluidine (MZ, MK)

MK: amine on toluene. O- biggest. Few issues with separation and safety. Once nitrated need separation, then hydrogenation.

MZ: a lot of distillation columns needed. Crystallisation possible

MK: toluidine really bad. Big indication that might not be nice to produce. Prices do look alright. Hydrogen bad.

Haloaniline (SN, YL)

SN: Main advantage: conventional operating conditions mild room and atmospheric. Utility cost favourable. Main limitation: separating impurities after synthesis difficult. Side reactions happen especially in

	hydrogenation. Possibility halogen group removed from benzene. Market: 4- most popular. Exact market demand not sure, but sigma prices decent. YL: difficulty as well of haloaniline: usually converted to aniline. Aniline price in Chinese market doesn't look favourable.
4 - Brief negotiation discussion	MJ: have to arrive with a list of prices on feedstocks and products. Wastes and purities. AY: no participation in negotiation.
5 – Company logo	MN: will send the logo in the chat. Combination of words "nitration" and "aromatics". AY: great AY: experience so far? MJ: too wide and daunting. AY: rationale: 2 factors – icheme accreditation; university strategy – projects cannot be pre-defined. Prioritise, and give summary of negotiation. **Next meeting: 13:00 Tuesday 26 January 2021.**

Actions

Description	**Assignee**	**Due**
Product selection		
- Figure out if "3 exemplars" can be 3 isomers. - If the process has to be, substituted aromatics - nitration-> nitrated aromatics -hydrogenation-> amino aromatics. - Number of exemplars. - Discuss proposed flow chart of products and reactions	MZ, MJ, HO, ST	14:20 19 January 2021
Prepare for the HSE meeting.	MZ, MJ, HO, ST	9:20 21 January 2021
Collect comprehensive data on markets and prices of products.	All	19 January 2021
Prepare for the separations meeting.	ZL, YL, SN	15:20 22 January 2021
Decide on compounds – come up with decision criteria and weights	All	20 January 2021
Decide on location of the plant – PESTEL analysis	All	20 January 2021

Approval

Dr Ali Yetisen *Facilitator*	Yuxin Liu *Chair*	Mingchuan Zheng *Secretary*

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