

BAKERY PROJECT REPORT

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1 SCENARIO

Startup Bakery is an Italian startup studio, i.e. a "generator of startups", a company that builds new enterprises in series following a "parallel entrepreneurship" approach.

The startup studio model aims at significantly reducing the risk of failure, typical of newly created enterprises while enhancing the quality of the new startups. The key idea is implementing a well-established receipt that makes the most of the lean approach and appropriately uses the latest Cloud and AI technologies. Startup Bakery has developed a business process to guide and monitor the execution of the activities required to launch a startup, they directly work on the project and finance part of the investments. The final target is to sell the startup created to a corporation so for this reason they aim to accelerate the growth of the startup in the market.

The creation of a new startup follows four main phases:

- **Pick Phase:** in this phase the company identify the best business idea that can fit with the market's needs. Such phase has a duration up to 6 months where they analyze different business idea with the help of a business analyst and an advisory committee, they evaluate each business idea by using different metrics.

Once the business idea is picked they make a so called **problem solution fit**, where there is an initial validation on the market, and if such validation has a positive outcome the business idea becomes a startup.

- **Mix Phase:** this phase has a duration of 6 months where there are different players involved in the validation of the startup. Some activities are: the engagement of co-founder, found the startup, register the brand, create a prototype of the software, get enough pre-orders (so they see if there is enough interest on the target) and look for external investments. This is the hardest phase because they need to lunch the startup in a limited time-frame so the operations need to run quite smoothly, every piece of the puzzle needs to fit.

- **Bake Phase:** The startup goes in the phase of development of the software, they hire different individuals for both the IT and the marketing domain. They are focused in the creation of startups with limited team and resources, such research begins from the Mix Phase and end in the Bake phase.
- **Exit/Serve phase:** They provide the startup to the corporation, and they work with them in order to facilitate the integration of the company in their processes.
As soon as they put the startup inside the corporation, there could be integration issues, because corporation have slow processes about bureaucracy. The processes of the created startup need to match with the ones of the corporation, they have to be sure the startup is very solid and quite organized.

2 GOALS

The most delicate phase of the Bakery Startup company, in the creation of new startups, is the Mix Phase. Here the activities are strictly dependent each other and just a reiteration of a given activity can increase significantly the risk of failure of the Mix Phase because of the limited time-frame imposed (six months). The company provided the process model of the Mix Phase, that is specified by a graphical representation through the Business Process Model and Notation. Moreover, some activities of the business process are annotated with related time constraints.

With the use of the BPMN model and the known time constraints the goals are:

- **GOAL 1:** Have an evaluation of the risk of failure of the process.
- **GOAL 2:** Reduce the risk of failure of the Mix phase's business process.

3 KNOWLEDGE UPLIFT MODEL

KUM for GOAL 1: Have an evaluation of the risk of failure of the process.

STEPS	INPUT	ANALYTICS/MODEL	TYPE	OUTPUT
STEP 1	BPMN, Known time constraints	Deduction of the time constraint for each activity in the BPMN	Prescriptive Knowledge	Time constraints of each activity
STEP 2	Mix Phase Logs, Time constraints	Time divergence between the time execution of each activity with its time constraint	Descriptive Knowledge	Time divergences
STEP 3	Mix Phase Logs	Detection of repeated activities	Descriptive Knowledge	Execution time of repeated activities
STEP 4	Target Mix Phase duration	Detection of a tolerance with respect to the target Mix Phase duration	Prescriptive knowledge	Mix Phase Tolerance
STEP 5	Time divergences, Execution time of repeated activities, Mix Phase Tolerance, target Mix Phase duration	Evaluation of the wasted time with respect to the Mix Phase Tolerance	Descriptive Knowledge	Measure of the risk of Failure

KUM for GOAL 2: Reduce the risk of failure of the Mix phase's business process.

STEPS	INPUT	ANALYTICS/MODEL	TYPE	OUTPUT
STEP 1	BPMN, Known time constraints	Deduction of the time constraint for each activity in the BPMN	Prescriptive Knowledge	Time constraints of each activity
STEP 2	BPMN, Time constraints	Detection of the most time-consuming activities	Descriptive Knowledge	Most time-consuming activities
STEP 3	Most time-consuming activities	Identification of pre-requisites to accomplish the most time-consuming activities	Descriptive Knowledge	pre-requisites
STEP 4	BPMN, logs	Detection of the most frequent loops	Descriptive knowledge	Top frequent loops
STEP 5	pre-requisites	Identification of prerequisites that can be accomplished in the the Pick Phase process	Predictive knowledge	Selected pre-requisites.
STEP 6	top frequent loops	Identification of activities in the loop that can be prepared in the Pick Phase	Predictive knowledge	Selected activities.
STEP 7	Selected pre-requisites, Selected activities	Business process modification of the Mix and Pick phase	Prescriptive knowledge	Modified BMPNs, modified time constraints.
STEP 8	Modified BMPNs, modified time constraints, logs of previous created star-tups	Evaluation of the new business process over previous logs	Descriptive knowledge	Validation of the modified BMPNs.

4 DATASET AND MATERIALS

In order to analyse the behaviour of the BPMN of the Mix Phase synthetic logs were generated by using the PM4PY library. The original **BPMN has been modified** in order to convert it into a valid Petri Net, from which by a playout of the network logs were generated. The algorithm generates in particular so called traces, where each trace correspond to the Mix Phase of a given startup. Each trace contains all the activities executed. The algorithm provided by the PM4PY library, the **BASIC PLAYOUT** function, has been **modified** in order to introduce to each activity a start and an end timestamp. Such timestamps are based on the relation of a given activity with its **direct antecedents** and on the **time constraints imposed** (plus some randomness' factor).

The unknown time constraints of the activities has been deducted by the time constraints provided by the company. Each time constraint correspond to the number of days ideally needed to accomplish a specific activity. The time constraints for each activity can be shown in the **github repository**.

Some traces has been filtered out from the logs, because of their alethic behaviour. Such filtering is based on the number of repetitions of specific activities. It has been decided to get as valid traces the ones that respects these rules:

Activity	MIN	MAX
Co-founder engagement	1	4
Documents collection	1	5
Naming	1	5
Prototyping refinements	1	3
Investors roadshow	1	2
Lean market validation	1	2

Using these rules the number of traces have been reduced from 200 to 49.

5 SOLUTION

5.1 SOLUTION FOR THE GOAL 1

For the first goal a function has been developed in order to get different metrics related to the overall time execution of a trace and metrics related to the time execution of single events. In particular what we obtain from such function is:

- For the trace:
 - Time duration of the trace: Tracked from the starting event to the ending event (expressed in days)
 - Timely activities: number of activities that respected the time constraint associated
 - Not timely activities: number of activities that didn't respect the time constraint associated
 - Time accuracy: the fraction of timely activities over the total number of events
 - Time divergence: the time divergence between the time duration of the trace and the target duration, that is in this scenario set to 6 months (expressed in days)
 - Process failure: is evaluated through the fraction of the time divergence of the trace over the tolerance value. The tolerance parameter is expressed as the maximum number of days that a trace execution can waste, w.r.t the target duration, over which the risk of failure is certain. I've set this parameter to 60 days.
- For each event of the trace:
 - The name of the activity
 - The starting timestamp of the activity
 - The ending timestamp of the activity
 - The time divergence between the time execution of the activity w.r.t the time constraint associated (expressed in days)
 - If the event fit or not the time constraint
 - Process failure: the measure of the risk of failure at that point in the timeline. Is evaluated by taking into account the time execution from the starting event to the current event and the target duration of the trace in the same point. Than the time divergence between these two elements will be used to evaluate the process failure.

Taking into account the 49 traces generated, in the average the results obtained through this function are:

Metrics	Average results
Time duration of a trace	203 days
Process failure measure	0.43 with a tolerance of 60 days
Time divergence	23 days
Number of activities	46

Most of the traces contains repetitions of some activities, the most time consuming repetitions are the ones that involves the "lean market validation" activity and the "investors roadshow" activity.

5.2 SOLUTION FOR THE GOAL 2

For the second goal my intuition is that there could be a selected sub-team of the company that put the basis for the activities of the Mix Phase of other business ideas. In particular instead of choose a single best idea, they can collect time to time other potential good ideas, each of this ideas should have passed the so called "problem solution fit" in the Pick Phase. So while the main team is occupied to the creation of a Startup in the Mix Phase, the sub-team is focused to put the basis for the next Startup.

Given a potential good idea, what they can do is:

- Check if there are potential Co-founders interested (in order to avoid the loop of the co-founder engagement activity);
- Pick different possible names of the startup, and make periodically the priority search (In order to delete the loop of the naming and the priority search activity);
- Identify the user personas before the mix phase (In order to reduce the time needed to execute the business idea consolidation);
- Identify the key-features of the software prototype and check before the Mix phase if such features are technically feasible (in order to reduce the time needed for the business idea consolidation, the product discovery prototyping activity);

Based on these assumptions a new BPMN is proposed and the time constraints of some activities has been modified:

- The time constraint of the "Product discovery prototyping" activity has been reduced of 7 days;

- The time constraint of the "Business idea consolidation" has been reduced of 2 days;
- The loop between the naming and the priority search has been removed;
- The loop of the Co-Founder engagement has been removed;

The new BPMN can be shown in the **Github repository**. Using the updated BPMN 56 valid traces as been generated and evaluated with the function developed in the first solution. In average the results obtained are:

Metrics	Old BPMN results	New BPMN results
Time duration of a trace	203 days	187 days
Process failure measure	0.43	0.28
Time divergence	23 days	7 days
Number of activities	46	43