# Acquisition of high-tech start-ups and knowledge management: the Google case

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**Résumé :**

Building on prominent knowledge management scholars (Grant, 1996; Nonaka, 1994; Simon, 1991) asserting that initially all knowledge is tacit and created by people, we assume that critical knowledge underlying start-up inception is tacit and embodied in its founders. Then, progressively, knowledge is disembodied to be crystallized in more tangible and explicit containers such as patents, technologies or products.

This evolution of knowledge tangibility related to start-up maturity makes HR management a strategic issue for acquirers to capture knowledge by retaining founders. Strategic HRM is critical when acquiring young start-ups and justifies sophisticated and specific HR practices to retain the founders (Kristiana et al., 2021).

This research builds on a study of 211 start-ups acquired by Google between 2001 and 2018, exploring the relationship between the presence and retention of start-up founders and the business maturity of the start-ups at the time of acquisition by a large firm.

**Key words:** Knowledge management, acquisition, strategic HRM, talent retention

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## INTRODUCTION

More and more companies use acquisition for growth purposes (Ranft & Lord, 2000). Strategic acquisitions can be an efficient path to company growth and gaining competitive advantage. Different motivations explaining acquisition activities exist. Golbe and White (1993) mention examples such as geographical expansion, increasing market share, economies of scale or diversification (Ranft & Lord, 2002).

More recent studies have highlighted the emergence of acquisitions aimed at the internalization of new knowledge, capabilities or technologies (Ranft & Lord, 2002; Park, Howard & Gomulya, 2018). Knowledge-Based View (KVB) (Nonaka, 1994; Grant 1996) highlights there are certain industries in which knowledge is a strategic resource for increasing competitiveness. For strategic purposes, companies may choose to acquire specific knowledge externally, rather than develop these capabilities internally: lack of time, costs, market pressure, urgency (Ranft & Lord, 2000). For this reason, integration of a firm which has already invested in the research and development of such knowledge can be strategically advantageous.

The acquisition of start-ups in particular is often the result of an interest in their technologies and capabilities (Puranam, Singh & Zollo 2006). Start-ups are particularly innovative and solution-driven. They are specialized in the development of new technologies as most often their sole existence can be explained by their founder's will to find innovative solutions to new problems. In industries such as the tech-industry, which are extremely competitive and fast-growing, the acquisition of start-ups is a rapid and efficient way to access key resources. High-tech start-up acquisitions' focus is very often knowledge-based assets as they are part of a

knowledge intensive industry (Coff, 1999). Such acquisition strategy is coined Acquisition & Development (in mirror of Research & Development) and represents a form of externalization by large firms of the exploration phase of innovation (Ferrary, 2011).

Start-ups are defined, among others, by their young age and youthfulness. In such companies, we hypothesize that knowledge is still tacit. For this reason, it is still for most part contained in the mind of the employees of the start-up and not yet disembodied into a marketable product (Grant, 1996). Due to this attribute, start-up acquisitions most often come with many challenges linked to the appropriation and integration of the knowledge of interest. These acquisitions therefore require efficient and carefully planned human resources management, in order to guarantee the best possible outcome and to capture embodied knowledge. In start-ups, critical knowledge is predominantly tacit and embodied in entrepreneurs and less explicit and crystallized in artefact such patents or products. Therefore acquiring start-ups means for the acquirer to acquire people more than tangible assets. This kind of acquisition is labelled acqui-hiring (Boyacıoğlu, Özdemir, & Karim, 2024) and HR management is critical to retain strategic talents (Kristiana, Panjaitan, Goeltom, & Prasetya, 2021).

In our research, we will focus on the tacitness of knowledge in young companies and the importance of efficient human resources management in the case of start-up acquisitions. We will focus on company maturity and its possible correlation with knowledge embodiment (tacitness) and explore different hypotheses linked to company maturity and employee fluctuation. Building on these hypotheses, we explore different cases of tech start-up acquisition made by Google in order to explicit our hypotheses with more concrete examples.

## 1. THEORETICAL BACKGROUND

### 1.1. KNOWLEDGE BASED-VIEW

The knowledge base-view (KVB) of the firm provides an extensive insight regarding the effect of knowledge on a firm's long-term success (Grant, 1996). The KVB can be considered as an

extension of the resource-based view (Barney, 1991), which states that key resources within a firm are considered as the main source of long-term competitive advantage. For resources to be a source of superior results, they must be valuable, rare, inimitable and non-substitutable (Barney, 1991).

As a variant of this theory, the KVB focuses only on intangible assets such as knowledge as the primary and most important source of sustainable competitive advantage for a company. The "utilization of knowledge within the firm to create value" (Grant, 1996: 110) is highlighted and value-creating knowledge is considered as the primary input for long-lasting superior returns.

Nonaka (1994) recognizes that there are different types of knowledge and distinguishes two types in particular: explicit and tacit knowledge. Both these types of knowledge differ from each other through their transferability. Explicit knowledge can be codified and transferred easily with no additional costs. It is thus considered as a publicly available unless it is for example patented. In contrast, tacit knowledge is only learnt through its application in practice. It is the skills and know-how of individuals acquired with time and through direct experience which creates valuable tacit knowledge within a firm.

Additionally, it is stressed that tacit knowledge is often embedded in complex social groups, which enhances its inimitably and complicates it transferability. The characteristics of tacit knowledge therefore cause it to be a unique source of long-term competitive advantage if exploited in the right way.

A more dynamic approach highlights the interactions between explicit and tacit knowledge and the possible conversions from one form of knowledge to another (Nonaka, 1994 Tacit and explicit knowledge can be differentiated by their levels of embodiment. We can consider the conversion of tacit knowledge to explicit knowledge as the disembodiment and crystallization of knowledge in a patent, a product or a serviceExplicit knowledge is highly disembodied, as it is codifiable and easily transferred through simple sharing or communication. In contrast, tacit

knowledge is highly dependent on its owner's experience and know-how and can therefore be considered as embodied in the individual who carries it.

In a dynamic perspective, the knowledge life cycle follows the start-up life cycle: at the beginning, the knowledge is tacit and embodied in a small group of people (the founders). With time, this tacit knowledge is socialized when more people are recruited into the company, then progressively externalized, disembodied and made explicit by the creation of a new product or service. The more mature the start-up, the more the knowledge is disembodied and explicit. Conversely, the less mature the start-up, the more the knowledge remains tacit and embodied in the founders. Depending on the target start-up's maturity, an acquirer will be buying knowledge which is more or less tacit and embodied. Thus, the management of corporate acquisitions might raise human resources issues.

For this reason, important human resources implications, such as employee retention strategies, must be considered and carefully managed, when engaging in knowledge acquisitions. When the acquisition involves internalizing tacit knowledge, it is crucial for the acquiring company to retain the employees who own this knowledge, as it is embodied. By letting go of the employees who carry the tacit knowledge of interest, the acquiring company risks losing this same knowledge. In contrast, the internalization of explicit knowledge requires less or no employee retention, as it is disembodied and materialized into a physical product or other artefact. The simple acquisition of the company, along with its patents and products, is sufficient to guarantee internalization of its explicit knowledge. Hence, as tacit knowledge is gradually converted into explicit knowledge, it becomes less decisive to retain the employees of the target company. Human resources and knowledge management must therefore be carefully adapted depending on the knowledge's nature and throughout its evolution.

### 1.2. ORGANIZATIONAL LEARNING

Grant (1996) also argues that competitive advantage obtained from knowledge is determined by the firm's capacity to efficiently integrate and organize this knowledge. Knowledge transferability is not sufficient for efficient integration and exploitation of this knowledge and two company traits which affect the final output originated from valuable knowledge: the firm's capacity for aggregation (adding new knowledge to the firm's existing knowledge) and capacity for appropriability (receiving return from that new knowledge).

When considering knowledge as a key source of competitive advantage, companies must be able to learn and therefore be a place where knowledge can grow and be developed. Nonaka (1994) argues that companies must provide a context for individuals to create knowledge and that their relative competitive advantage is dependent on whether the firms effectively amplify and process that knowledge through knowledge coordination.

It is not the company itself which learns, but the individuals within companies who accumulate and are able to assimilate new knowledge (Simon, 1991). For this reason, "an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have" (Simon, 1991: 125). This explicitly highlights the strategic role of key talents in a company for effectively competing against other companies. Knowledge value and the generation of possible superior returns is dependent on the minds of individuals to process, assimilate and use that knowledge effectively. For this reason, it is not only knowledge which is a key resource but mainly the individuals who own the knowledge.

### 1.3. ACQUI-RING: ACQUISITIONS AND ORGANIZATIONAL LEARNING

Acqui-hiring is one possible strategy for organizational learning: the acquisition of companies with the purpose of internalizing their technologies and capabilities, through the ingestion of key employees of the target company (Park, Howard, Gomulya 2018).

These strategic acquisitions enable firms to access valuable knowledge and simultaneously hire the talents who initially developed the knowledge. In some cases, it is only the appropriation of the knowledge which is the focus of the acquisition. But if the technology is tacit and still embodied, it is then strategically decisive to retain the human resources after the acquisition (Park, Howard, Gomulya 2018).

Even though knowledge-oriented acquisitions offer many valuable opportunities for companies, many studies have revealed an important number of challenges linked to knowledge tacitness when attempting to internalize external technologies and capabilities. In fact, acquisitions often fail to achieve the anticipated outcomes and result in creating additional management problems.

Firstly, as tacit knowledge is embodied in people, it is difficult for the acquiring company to assess the real value of this knowledge. The acquiring company must cope with uncertainties linked to quality, transferability and potential synergy of the knowledge-based assets (Coff, 1999).

Since intangible assets such as knowledge are not included in financial statements, the target company is free to provide or withhold any information which would enable to better assess the real quality of the knowledge. Moreover, due to its tacitness, knowledge is not always easily transferable from one company to another and synergies between the acquired knowledge and already-owned knowledge are difficult to predict and estimate (Coff, 1999).

Studies have revealed significant personnel fluctuation in the period following an acquisition (Ernst and Vitt 2000, Ranft and Lord 2000). This increase in key employees leaving the company can be "viewed as a serious challenge to the success of the acquisition" (Ranft & Lord, 2002: 433). Important loss of skills and expertise is most often inevitable when key employees depart, which threatens efficient exploitation of the target company's technologies and capabilities.

Simon (1991) also argues that personnel turnover is an important threat to organizational memory and knowledge. As knowledge is contained in the minds of the employees, their leaving after an acquisition consists in a threat to the preservation of the target company's knowledge. He also highlights the importance of knowledge familiarity and having had "the actual experience activities and responsibilities of the other group" (Simon, 1991, p.131) for effective knowledge coordination.

Other research has proven that retaining key scientists after an acquisition is correlated to the preservation of the target company's tacit knowledge (Ranft and Lord 2002) and to the potential creation of breakthrough knowledge (Park, Howard, Gomulya 2018).

Loss in productivity of target firm employees has also been identified as a potential issue after an acquisition: inventive performances decrease, whether in quality or quantity (Ernst and Vitt, 2000). One reason explaining target employee productivity disruption is a decrease in relative standing (Ranft and Lord, 2000). After an acquisition, employees from the acquired company may feel a sense of social disruption: reduction of their level of autonomy, loss of status and unclear evidence of acquirer's commitment to the success of the acquisition have proven to negatively affect human capital retention (Ranft and Lord 2000).

Acquirers also face a difficult trade-off regarding the degree of integration of the target company. Granting high levels of autonomy to the acquired firm seem to significantly reduce knowledge sharing and therefore negatively impact value created from the coordination of existing and acquired knowledge. In contrast, integrating the target company increases the chances of the acquired knowledge being disrupted (Paruchuri, Nerkar, Hambrick 2006; Puranam, Singh, Zollo 2006). Puranam et al. (2006) suggest that the strategic choice regarding level of integration and autonomy during an acquisition should depend on the developmental stage of the acquired company: if the target company is going through a more exploration-intensive activities and focused on innovating, it is in the acquirers best interest to grant it high

levels of autonomy in order to not disrupt its innovative phase. Contrarily, if the target company is more exploitation-oriented, integration through coordination strategies should lead to superior results. This perspective highlights the importance of the acquired firm's developmental stage in the choices of acquisition coordination strategies and therefore in the ultimate success of failure of the acquisition.

## 2. HYPOTHESES

Building on the idea that the acquired firm's developmental stage can be decisive in the management of an acquisition, one focuses more precisely on target company's maturity and the derived human resources implications which occur during an acquisition. Our basic proposition is that human resources strategies, in particular linked to employee retention, should be adapted depending on the maturity of the target company. The younger the target company, the more important it is for the acquiring company to retain the employees after the acquisition. The same reasoning can be applied conversely.

Previous research has highlighted the risks linked to the simple hiring of knowledge employees. Simon (1991) explains how the knowledge of newcomers, and in particular single workers, will very likely be disrupted by the existing knowledge and embedded culture of the acquiring company. Already dominating patterns will be transmitted to the foreign employee, which prevents any new knowledge from being efficiently integrated and exploited. For this reason, one suggests that the simple hiring of knowledge employees might lead to the engulfment and disruption of their knowledge.

In contrast, numerous studies stress corporate acquisition implementation problems linked to cultural differences between the acquirer and the target company. When organizational culture is strong, companies tend to be resistant to change and clashes in systems, procedures and strategies can occur (Ranft & Lord, 2002; Ernst & Vitt, 2000). Consequently, when a company is mature and its culture deeply rooted, dissimilarity issues can lead to failures in the integration

of the target company and its knowledge. One therefore hypothesizes that there is an ideal maturity range of the acquired company in which neither will the knowledge be disrupted by the acquirer nor will it fail to be integrated due to culture shock. In that sense, start-up companies appear to be good candidates for corporate acquisitions aimed at knowledge and technology internalization. Acquiring start-up companies is an interesting compromise: on the one hand, their technology and knowledge is sufficiently robust and mature to not be disrupted by the size and culture of the acquiring company. And on the other hand, it is young and innovative enough to be efficiently articulated along with the existing knowledge for positive results and potential growth. One could assume that there is an inverted-U shaped correlation between success of acquisition and company maturity.Start-up companies would stand in the optimal maturity range for knowledge-oriented corporate acquisitions.

To better understand the possible link between target company maturity and the positive outcome of an acquisition, we explore in more detail how knowledge tacitness is related to its maturity. As mentioned above, tacit knowledge is deeply embedded in actions, routines and procedures and can only be achieved through direct experience. For this reason, it can only be transmitted with time, as individuals must themselves engage in the practice of such knowledge in order to internalize it. Moreover, it is embodied in people and social networks who own the practical "know-how".

Nonaka (1994:25) mentions how knowledge has to be "crystallized into some concrete "form" such as a product or a system" by the process of internalization (the conversion of tacit knowledge into explicit knowledge). Building on these theories, we suggest that immature knowledge and technology is more tacit and embodied in people. In contrast, with time and increase in maturity, tacit knowledge is gradually converted into explicit knowledge, and disembodied into a more tangible product or system. Once the initially tacit knowledge is crystallized and converted into explicit knowledge, it can then be codified and patented. In this

manner, the acquiring company can then take full ownership of the acquired knowledge. As the knowledge is not embodied anymore, the acquiring company depends less on the target company's employees to exploit the knowledge.

Additionally, by hypothesizing that knowledge and technology maturity can be directly linked to company maturity, we advance that the more mature the company, the more explicit and disembodied the knowledge and technology.

For all of these reasons, it is valuable to study the presence of founders in the target company during an acquisition. One focuses here on start-up founders in particular (and not on all employees) as they are the ones who own critical knowledge and coordinate it to innovate and create solutions.

Based on the theory regarding knowledge disembodiment with time, we can study whether founders are present or not in the startup during an acquisition in link to its maturity. As already mentioned, if the startup is less mature, the knowledge is expected to be tacit and embodied. For this reason, the founders who carry this young knowledge should assumingly still be present in the startup for its development. The efficient up-bringing of knowledge to a mature and marketable product is dependent on the founders' know-how. In contrast, if the startup is more mature, its knowledge is presumed to be more explicit and disembodied into patented products for example. Founders are therefore less likely to be present in the startup. This can for example be explained by the fact the startup founders have less interest in the exploitation of a mature product, and more interest in the development of a new project elsewhere. Moreover, acquiring companies may aim their interest at start-up companies whose founders are still present, in order to maximize the transfer of tacit knowledge between the existing employees and the start-up founders. The more mature the start-up is, the more the innovative knowledge is explicit and crystallized in artefacts and less tacit and embodied in innovators.

*<u>Hypothesis 1:</u> The presence of founders in a start-up during its acquisition is dependent on its maturity.*

In addition to founder presence, several studies have already stressed the importance of talent retention in the period after an acquisition when the acquired knowledge is tacit, and how it is less decisive when the acquired knowledge is explicit (Ranft & Lord, 2000; Park, Howard & Gomulya, 2018; Ranft & Lord, 2002). Building on our previous hypotheses regarding the correlation between company maturity and crystallization of knowledge, we identify a possible link between the company's maturity and the need to retain employees after an acquisition. In young and immature companies where knowledge is still tacit and not yet disembodied, the retention of the employees who own the knowledge and know-how can be decisive for the success of the acquisition. In fact, losing these employees could result in losing the acquired knowledge, which was the initial objective of the acquisition. When acquiring new start-ups. HR management practices (compensation & benefit, training, career opportunities and work conditions) are critical to retain strategic talents and capture their embodied tacit knowledge (Kristiana, Panjaitan, Goeltom, & Prasetya, 2021).

Moreover, considering we are focusing on start-up acquisitions, we can hypothesize that it is the founders of theses start-ups who own the tacit knowledge, as they are the ones who initiated the creation of an organizations to coordinate their ideas and knowledge in order to innovate and create new solutions. For this reason, founder retention appears to be crucial when companies are less mature, and knowledge is still tacit.

In contrast, when knowledge is disembodied, it is then less decisive for the company to retain the employees who initially developed and owned this knowledge (in our case, we consider that these employees are the founders of the start-up). The acquiring company might invest less means to retain founders after the acquisition in such a situation. In this manner, we suggest

that during corporate acquisitions, there is a negative correlation between company maturity and start-up founders' retention.

*Hypothesis 2a:* *As knowledge disembodiment is positively correlated with start-up maturity, we advance that the younger the acquired start-up, the more the acquiring company will attempt to retain the start-ups' founders. There is a negative relationship between acquired start-up maturity and founder retention.*

Bringing this reasoning slightly further, we can also study how long start-up founders are retained by the acquiring company, depending on the maturity of the target start-up. In the case of an acquisition of young startup in which the knowledge is still embodied, it is expected from the acquiring company to increase its founders retention strategies in order to avoid any risks of losing the tacit knowledge before it is crystallized, and consequently losing the opportunity to exploit this new knowledge. Retention strategies will be maintained as long as the knowledge is still tacit and embodied. These retention strategies will decrease while maturity increases and knowledge is disembodied, crystalized and codified.

*Hypothesis 2b:* *The younger the acquired start-up, the longer will the founders stay in the company post-acquisition, and vice versa.*

Furthermore, when there are several founders in a start-up, it can be studied how many founders are present after the acquisition, depending on the maturity of the start-up. In fact, we can hypothesize that when a young start-up was founded by more than one person, the valuable knowledge is likely to be shared. In this sense, the technology which is being developed is dependent on the combination and addition of the experience and know-how of the different founders. With time and increase in maturity, and as tacit knowledge is gradually converted into explicit knowledge, it is less decisive for all of the founder to be present in the start-up. As

retention strategies can be costly, the acquiring company might invest less in the retention of all the founders and settle for retaining less and less founders as maturity increases.

*Hypothesis 2c: The number of founders present in a start-up after its acquisition depend on the maturity of the start-up*

## 3. METHODS

### 3.1. Sample and Data Sources

For our research, we gathered information regarding all of Google's acquisitions between 2001 and 2018. For every acquisition, the following information was compiled: Start-up's name, foundation date and business field and acquisition date. The Google business in which the start-up's technology was then integrated was also indicated in our data. In total, information regarding 211 start-up acquisitions by Google was found.

Because we are focusing on employee retention post acquisition, we gathered information regarding founders' professional situation at the time of and following the acquisition. Most of this information could be found on the founders' LinkedIn pages: name and date of professional mobility. This information was collected for up to 5 founders per company, when pertinent. When founders left the start-up before its acquisition, we did not collect the founder's year of departure. Moreover, our data indicated whether the founder was present or not at the time of the acquisition. It is important to note that the numbering of the founders does not give any indication regarding the importance of the founders in creating the startup. Thus, the implications linked to their retention (along with their knowledge) as individuals are the same.

### 3.2. Measures

As our study focuses on the impact of acquired start-up maturity and employee retention during knowledge-oriented acquisitions, we computed several outcome variables. First, we calculated the start-up's maturity at the time of acquisition based on its foundation date and acquisition

date. This variable was named *Maturity*. Then, for each start-up founder, we computed his *Seniority* at time of acquisition and after (his leaving the startup after its acquisition). This was done based on the acquisition date and the founders' leaving dates.

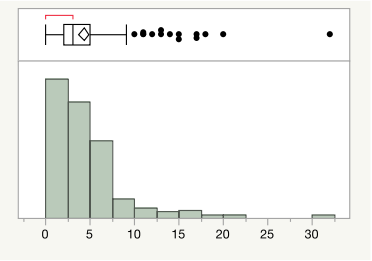
Hypothesis 1 studies the implications the target firm's maturity (therefore its knowledge maturity) may have on the acquiring company's employee retention strategies through different measures. For this reason, we computed several outcome variables in order to measure possible correlations between firm maturity and employee retention. Firstly, we computed the mean seniority of the founders for each start-up. Moreover, we computed the cumulated number of founders still present in the start-up for years one, two and three after the acquisition. We initially stopped this cumulation at year three basing ourselves on Ernst & Vitt (2000) methodology, which considers employee departure occurs if an employee leaves within the first three years after an acquisition. In order for these numbers to be comparable between start-ups, we computed the proportion of founders present after one, two and three years. After computing results for years 0 to 3 post acquisition, we decided to add some observation regarding founder professional mobility 5 years post acquisition for more details.

Hypothesis 2 focuses on the presence of founders at the time of the acquisition in regard to the target company's maturity. We computed the proportion of founders present in the start-up at the moment of the acquisition by dividing the total number of founders of the start-up by the number of founders present at the time of acquisition.

## 4. RESULTS

### 4.1. DESCRIPTIVE STATISTICS

*Figure 1. Distribution of Maturity*



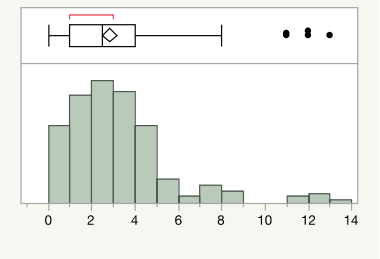

| | |
|---|---|
| *Mean* | *4.2606635* |
| *Std Dev* | *3.986085* |
| *Std Err Mean* | *0.2744134* |
| *Upper 95% Mean* | *4.8016215* |
| *Lower 95% Mean* | *3.7197055* |
| *N* | *211* |
| *Minimum* | *0* |
| *Maximum* | *32* |
| *Median* | *3* |
| *Mode* | *1* |
| *Range* | *32* |

The distribution of the start-up's maturity can be found on figure 1. Maturity ranges from 0 to 32 years, but there is a clear majority of start-up's whose maturity is contained between 1 and 5 years. This can be observed visually in the histogram as well as numerically in the quantiles of the boxplot. More precisely, the mode maturity is 1 year and the median maturity 3 years. The main exception is Motorola mobility, a 32 years-old firm, acquired by Google in 2012

To identify outliers, we performed an outlier boxplot distribution. In the boxplot distribution, 15 observations are considered outliers. An observation was considered an outlier if not included in the following range: 1$^{st}$ quartile – 1,5*(interquartile range) and 3$^{rd}$ quartile +

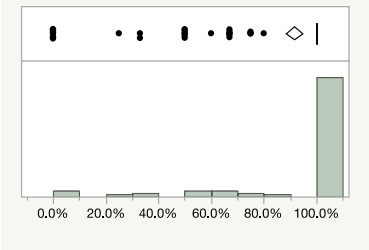
1.5*(interquartile range). Based on this, we will later perform regression analysis without these outliers.

*Figure 2. Distribution of Mean seniority of start-up founders*




We calculated the mean seniority of the founders of each start-up company. This represents the average number of years founders stayed in the start-up after the acquisition occurred. The summary statistics show most founders remained in the start-up between 1 and 4 years post acquisition. The overall mean is 2.83, which is a good indicator of how long founders were in average retained post acquisition.

*Figure 3. Distribution of Proportion of founders present at moment of acquisition*




In this distribution, 180 out of 211 acquired start-up had 100% of their founders present at the moment of the acquisition. The average proportion of founders present in the start-up during that period is 91.51%. This gives us an indication regarding the significant presence of founders at the moment of the acquisition .

*Figure 4 and 7. Distributions of Proportion of founders present 1 and 5 year(s) after acquisition*

*Figure 4*

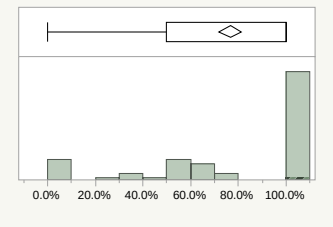
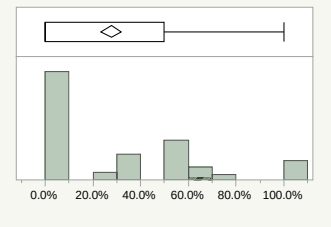



*Figure 7*




When looking at the distribution of the proportion of founders still present in the company after 1, 2, 3 and 5 years after the acquisition, it is interesting to note the evolution of different measures. Firstly, the mean clearly decreases from year 0 to year 3: initially at 91,51%, it decreases to 76,52% at year 1, to 65,88% at year 2, to 52,09% at year 3, and to only 27,57% at year 5. The median and the mode decrease as well, but more significantly as after year 3. Finally, the histograms enable us to visually witness the skewness of the distribution changing from negative to positive.

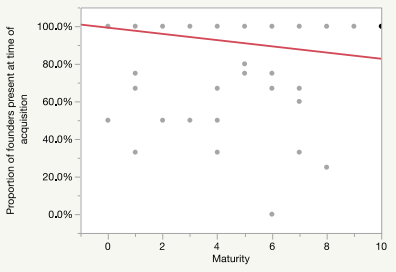
These measures show there is a clear tendency of founders leaving the startup in a short period following the acquisition.

### 4.2. REGRESSION ANALYSES

#### 4.2.1. Outliers excluded

The following measures enable us to more closely analyze the possible link between the maturity of a start-up at the time of its acquisition and the professional mobility of its founders after the acquisition. A regression analysis was performed, with the maturity of the start-ups at the time of the acquisition as the independent variable. We analyzed the presence of the founders post acquisition as the dependent variables. The results below present the regression analysis excluding the outliers, with a 95% confidence interval.

*Figure 8. Fit Y by X: Maturity VS Proportion of founders present at moment of acquisition*




The results excluding outliers indicate a weak but negative correlation (-0.1887) between the maturity of the start-up and the proportion of founders present at the time of the acquisition (0 years post acquisition). The slope of the regression line is -0.016, which is weak. Moreover, the p value being 0.0081 (<0.05), this indicates we can reject the null hypothesis (we reject the hypothesis that maturity has no effect on the proportion of founders present at the time of the acquisition). R square is quite weak (0.036), which indicates only a very small proportion of the variation can be explained by our independent variable *Maturity*.

These results highlight a negative relationship between the maturity of the start-up at the time of its acquisition and the presence of founders the year of the acquisition: the more mature the company at the time of its acquisition, the less founders are present in the start-up the year of its acquisition.

*Figures 9, 10, 11, 12. Fit Y by X: Maturity VS Proportion of founders present 1,2,3,5 years after acquisition (excluding outliers)*

Regression analyses excluding outliers for the proportions of founders present 1,2,3 and 5 years after the acquisition in link to the start-up's maturity are the following: correlations are all negative but weak (-0.054 for year 1, -0.062 for year 2, -0.046 for year 3, -0.006 for year 5). The slopes of the regression lines are respectively -0.008 (year 1), -0.010 (year 2), -0.008 (year 3), -0.001 (year 5). These indicate very weak slopes. Moreover, R squares are all below 0.004 and p values are all above 0.05. This indicates that only a negligible proportion of the variation

Commenté [A1]: Quels sont les outliers que vous avez retiré, pourquoi et combien?

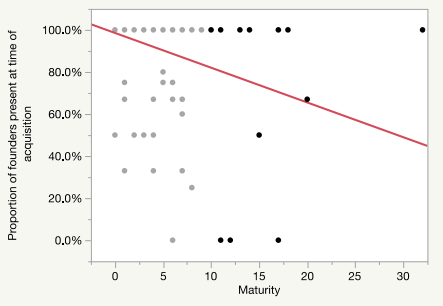
Commenté [A2]: Mêmes questions

can be explained by our variable *Maturity* and that we cannot reject the hypothesis that *Maturity* has no effect on the proportion of founders present 1, 2, 3 and 5 years after the acquisition. The results do not enable us to establish a possible link between the maturity of the start-up at the time of its acquisition and the founders' fluctuation post acquisition.

**4.2.2. Outliers included**

As results were not very conclusive, we performed the regression analyses but this time including the outliers for years 0,1,2,3 and 5 post acquisition.

*Figure 13. Bivariate Fit of Proportion of founders present at time of acquisition By Maturity*




Regarding the interaction between maturity and proportion of founders present at the time of the acquisition, results are similar but slightly stronger. In fact, the correlation this time is -0.2843, which is stronger than when performing the regression analysis without the outliers. The slope of the regression line is almost identical (-0.016) and R square is higher (0.08) but still weak. Here again, the p value is lower than 0.05, which means we can reject the hypothesis that *Maturity* has no effect on the proportion of founders present at the time of the acquisition. This supports again our hypothesis that there is a negative relationship between the maturity of an acquired start-up and the presence of founders at the time of the acquisition.

*Figures 14, 15, 16, 17. Maturity VS Proportion of founders present 1,2,3,5 years after acquisition (including outliers)*

Regression analyses regarding the interaction between the start-up's maturity at the time of the acquisition and the founders' presence 1,2,3 and 5 years after the acquisition are slightly different. In fact, correlations are all higher (-0.11 for year 1, -0.15 for year 2, -0.08 for year 3 and -0.07 for year 5). On the other hand, p values are all above 0.05 and R squares still weak. Slopes of the regression lines remain negative but weak as well. We retain from these results that although weak, the relationship between acquired start-ups' maturity and founder fluctuation post acquisition is a negative relationship, and that it is grows weaker as the years go by.

*Figure 18. Fit Y by X: Maturity VS Mean seniority of start-up founders*

Results indicate a negative but very weak correlation (-0.021). The slope of the regression line is also weak (-0.0196). Moreover, R square is extremely low (0.00046) and the p value is higher than 0.05, which indicates we cannot reject the hypothesis that there is no effect of start-up maturity on the mean seniority of start-up founders.

**5. DISCUSSION**

We studied how start-up maturity, and more precisely knowledge maturity, may have an impact on the importance of employee retention strategies. For this, we analyzed the behavior of start-up founders in the years following the start-up's acquisition.

We found a negative relationship between the maturity of the acquired start-up and the presence of founders at the time of the acquisition. More precisely, it seems that for young start-ups, whose knowledge and technologies are still new and more tacit, founders are still present for development and exploration purposes. In contrast, it was observed that founders are less present in acquired start-ups as the start-up's maturity increases, and indirectly the knowledge is disembodied and crystalized. In our Google case study, it is quite clear that Google does not

acquire start-ups without their founders, which is an indicator of the importance of founder presence during corporate acquisitions.

The Motorola Mobility deal by Google[1] illustrates this result. After Motorola Mobility, founded following the split of Motorola Inc., refused to sell its patent portfolio to Google, Google managed to acquire and merge Motorola Mobility for a substantial price ($12,5 billion). The target company's CEO Sanja Jha was not the founder and stepped down as soon as the deal was closed. This did not affect the efficient exploitation of the newly acquired company. In fact, Google's main motivation in acquiring Motorola Mobility was the internalization of the company's valuable patent portfolio, which later on benefitted to the development of Android and other mobile device projects Google undertook. This example highlight how mature and explicit knowledge (in this case, patented technology) requires little or no founder presence for its efficient exploitation.

Another similar example is the DoubleClick acquisition by Google in 2007. DoubleClick was founded back in 1996 and was specialized in online advertising. When it was acquired and merged into Google's advertisement activities, the company was already 11 years old and considered a serious player in its field, with business clients such as Nike, Apple, Coca-Cola etc. This could explain why the absence of all founders at the time of its acquisition did not affect the efficient internalization of the company's know-how into Google's advertisement activities.

Conversely, some of Google's acquisitions of young start-ups required founders' presence to be able to appropriate their tacit knowledge. Android for example, founded in 2003 and specialized in mobile operating systems, was purchased by Google only 2 years later in 2005[3]. At the moment of the acquisition, Android was still a young and small Californian start-up company run by the three founders: Andy Rubin, Rich Miner, Nick Sears and Chris White. At that time, their technology was still in a developmental stage, as their first product release

occurred years later, in September 2008. Following the acquisition, only Chris White left the company after a short period of time. The two other founders remained in the company for several years, bringing the technology to full maturity and exploitability: Nick Sears left the company after a whole 8 years, and Andy Rubin after 9 years. Andy Rubin though, before his leaving, was offered to take over other developmental projects within Google. He since then founded start-up company Playground Global in 2015, whose backers include Google, among others[4]. As for Rich Miner, he still works with Android and Google. Simultaneously to his responsibilities regarding Android, he was able to continue developing other products: he is currently board member of the start-up companies Tamr Inc and Recorded Future, both financially backed-up by Google Ventures[5].

This acquisition marks Google's entrance in the mobile communications sector and has proven to be a great success. Google's careful human resources management of Android's founders could explain its success: enabling these innovative minds to continue flourishing freely while simultaneously bringing the initial product to full maturity and marketability. Not to mention, these retention strategies simultaneously offer the opportunity for Google to access first hand innovative and competitive tacit knowledge.

Similarly, the video sharing website Youtube[6] is another example which supports our hypothesis. Acquired by Google in 2006 only one year after its foundation, Youtube became a world leader in its sector. Initially founded by three former colleagues, Chad Hurley, Steve Chen and Jawed Karim, Google made sure at least two of these founders remained in the company long enough for the project to be sufficiently developed. Chad Hurley was offered over 694000 Google shares and stayed in the company during 5 years after the acquisition[7], while Steven Chen for his part received over 625000 Google shares and left after 2 years[8]. Following this, they together started developing a new project, financially backed-up by Google Ventures: Avos Systems. Since then, they split paths. While Chad Hurley is still working on

this project, Steve Chen, for his part, has started working at Google Ventures as an entrepreneur. Offering Google shares as well as new opportunities for innovative project development can be interpreted as an efficient incentive for retaining the founders long enough for their know-how to be fully transmitted into the developed product.

The following example illustrates our hypothesis in a converse manner. Titan Aerospace was purchased by Google one year only after its creation by Maximus Yaney in 2013[9]. Unfortunately, he left the company to develop other ideas a few months after the acquisition. Later on, in 2017, Google announced it was abandoning the project completely.

The same thing happened to dMarc Broadcasting[10], young startup purchased by Google, both whose founders left only one year after the acquisition was completed. The advertising project was discontinued two years later.

## 6. CONCLUSION

A strategic justification of acquisitions of businesses by large firms is to acquire critical knowledge. However, when it comes to knowledge management, it matters to differentiate the content and the container. Tacit and explicit knowledge are contained in different containers. Building on prominent knowledge management scholars (Grant, 1996; Nonaka, 1994; Simon, 1991) asserting that initially all knowledge is tacit and created by people, we assume that critical knowledge underlying start-up inception is tacit and embodied in its founders. Then, progressively knowledge is disembodied to be crystallized in more tangible and explicit containers such as patents, technologies or products.

This evolution of knowledge tangibility related to start-up maturity makes HR management a strategic issue for acquirers to capture knowledge by retaining founders. Strategic HRM is critical when acquiring young start-ups and justifies sophisticated and specific HR practices to retain the founders (Kristiana et al., 2021).

As the success of knowledge-based start-up acquisitions is affected by human resources stability, it is important to study the factors which influence founders' professional mobility. In our study, we aimed our attention at the impact of knowledge and technology maturity on human resources strategies and challenges during corporate acquisitions. For this, we focused mainly on high-tech start-up companies, which are characterized by knowledge-intensive human resources. We analyzed the founders' presence and professional mobility in the years following the acquisition in link to the start-up's maturity at time of acquisition, in order to determine whether acquiring companies must potentially adapt their retention strategies in regard to knowledge maturity. We based ourselves on the main idea that knowledge crystallization is linked to technology maturity, therefore indirectly to company maturity. We found that acquiring companies tend to buy start-up companies with their founders.

## 7. LIMITATIONS

Some limitations to this study exist, which provide future research opportunities and perhaps more conclusive results. Firstly, our study's sample considers only acquisitions performed by Google. This limits our research to a single context in different manners: the studied sector is restricted to the high-tech industry, although other knowledge-intensive industries exist. Geographical location and corporate culture may also impact acquisition strategies. Although we cannot exclude that other context might reveal similar results, it may be interesting for future studies to include other frameworks as well.

Second, we did not take into account the year of creation of the target start-up company in our study. In fact, the high-tech industry is extremely fast-moving, which is one of the reasons justifying corporate acquisition strategies. But this implies that technologies from different times may mature at different speeds. As our database includes acquisitions which occurred between 2001 and 2018, we can assume that technologies and innovations developed almost 20 years apart may evolve in an extremely different manner, and especially in speed of maturation.

This may affect comparability in between acquisitions which happened during different technology periods, as knowledge crystallization may happen at a different speed.

Thirdly, considering Google's extremely diverse sector coverage, limitations occur in a similar way in regard to the numerous different types of businesses Google acquired. In fact, the acquired companies' business sectors ranged from satellite development, to online advertising, including video gaming, travelling, mapping and many others. Diverse business sectors imply the use of different technologies and types of knowledge. Different categories of businesses and technologies may not mature at the same pace, as different types of knowledge may crystalize at different rates. This impacts the comparability of different target start-ups, as their maturity levels and maturing speeds may be interpreted in different manners. For this reason, future studies may want to take into account the diverse technology maturing rates depending on the business sector of the target company and its time of creation.

**REFERENCES**

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, *17*(1), 99-120.

Boyacıoğlu, B., Özdemir, M. N., & Karim, S. (2024). Acqui-hires: Redeployment and retention of human capital post-acquisition. *Strategic Management Journal*, *45*(2), 205-237.

Coff, R. W. (1999). How buyers cope with uncertainty when acquiringfirms in knowledge-intensive industries: Caveat emptor. *Organization Science*, *10*(2), 144-161.

Ernst, H., & Vitt, J. (2000). The influence of corporate acquisitions on the behaviour of key inventors. *R&D Management*, *30*(2), 105-120.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic management journal*, *17*(S2), 109-122.

Kristiana, Y., Panjaitan, A., Goeltom, V. A., & Prasetya, A. B. (2021). Managing employee retention in mergers and acquisitions: A systematic review. *International Journal of Social, Policy and Law*, *2*(4), 44-54.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, *5*(1), 14-37.

Park, H. D., Howard, M. D., & Gomulya, D. M. (2018). The impact of knowledge worker mobility through an acquisition on breakthrough knowledge. *Journal of Management Studies*, *55*(1), 86-107.

Paruchuri, S., Nerkar, A., & Hambrick, D. C. (2006). Acquisition integration and productivity losses in the technical core: Disruption of inventors in acquired companies. *Organization science*, *17*(5), 545-562.

Puranam, P., Singh, H., & Zollo, M. (2006). Organizing for innovation: Managing the coordination-autonomy dilemma in technology acquisitions. *Academy of Management journal*, *49*(2), 263-280.

Ranft, A. L., & Lord, M. D. (2000). Acquiring new knowledge: The role of retaining human capital in acquisitions of high-tech firms. *The Journal of High Technology Management Research*, *11*(2), 295-319.

Ranft, A. L., & Lord, M. D. (2002). Acquiring new technologies and capabilities: A grounded model of acquisition implementation. *Organization science*, *13*(4), 420-441.

Selby, J., & Mayer, K. J. (2013). Startup firm acquisitions as a human resource strategy for innovation: The Acqhire phenomenon. In *Academy of Management Proceedings* (Vol. 2013, No. 1, p. 17109). Briarcliff Manor, NY 10510: Academy of Management.

Simon, H. A. (1991). Bounded rationality and organizational learning. *Organization science*, *2*(1), 125-134.

**ANNEXES**

Figure 1 : Distribution of Maturity

| | |
|---|---|
| Mean | 4.2606635 |
| Std Dev | 3.986085 |
| Std Err Mean | 0.2744134 |
| Upper 95% Mean | 4.8016215 |
| Lower 95% Mean | 3.7197055 |
| N | 211 |
| Minimum | 0 |
| Maximum | 32 |
| Median | 3 |
| Mode | 1 |
| Range | 32 |

| | | |
|---|---|---|
| 100.0% | maximum | 32 |
| 99.5% | | 31.28 |
| 97.5% | | 16.4 |
| 90.0% | | 8 |
| 75.0% | quartile | 5 |
| 50.0% | median | 3 |
| 25.0% | quartile | 2 |
| 10.0% | | 1 |
| 2.5% | | 0 |
| 0.5% | | 0 |
| 0.0% | minimum | 0 |

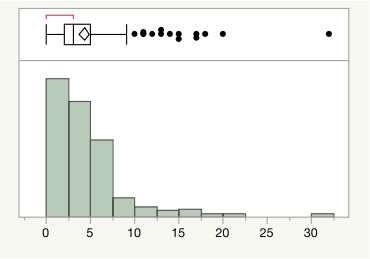
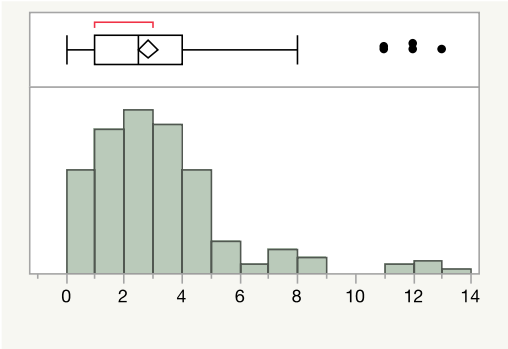


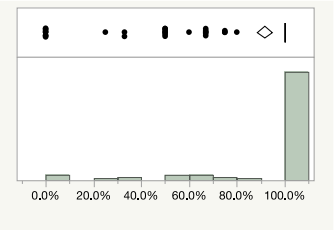
Figure 2. Distribution of Mean seniority of start-up founders




| | |
|---|---|
| Mean | 2.83875 |
| Std Dev | 2.4075751 |
| Std Err Mean | 0.1702413 |
| Upper 95% Mean | 3.1744584 |
| Lower 95% Mean | 2.5030416 |
| N | 200 |
| Minimum | 0 |
| Maximum | 13 |
| Median | 2.5 |
| Mode | 3 |
| Range | 13 |

| | | |
|---|---|---|
| 100.0% | maximum | 13 |
| 99.5% | | 12.995 |
| 97.5% | | 11 |
| 90.0% | | 5.3333333333333 |
| 75.0% | quartile | 4 |
| 50.0% | median | 2.5 |
| 25.0% | quartile | 1 |
| 10.0% | | 0 |
| 2.5% | | 0 |
| 0.5% | | 0 |
| 0.0% | minimum | 0 |

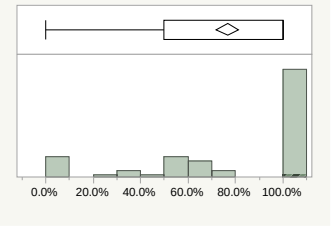
Figure 3. Distribution of Proportion of founders present at moment of acquisition




| | |
|---|---|
| Mean | 0.9150711 |
| Std Dev | 0.2318361 |
| Std Err Mean | 0.0159603 |
| Upper 95% Mean | 0.9465339 |
| Lower 95% Mean | 0.8836082 |
| N | 211 |

| | | |
|---|---|---|
| 100.0% | maximum | 100.0% |
| 99.5% | | 100.0% |
| 97.5% | | 100.0% |
| 90.0% | | 100.0% |
| 75.0% | quartile | 100.0% |
| 50.0% | median | 100.0% |
| 25.0% | quartile | 100.0% |
| 10.0% | | 67.0% |
| 2.5% | | 0.0% |
| 0.5% | | 0.0% |
| 0.0% | minimum | 0.0% |

Figure 4. Distribution of Proportion of founders present 1 year after acquisition

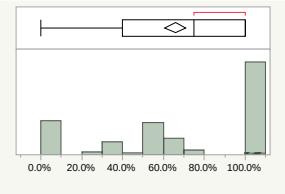



| | |
|---|---|
| Mean | 0.7651659 |
| Std Dev | 0.3437543 |
| Std Err Mean | 0.023665 |
| Upper 95% Mean | 0.8118173 |
| Lower 95% Mean | 0.7185144 |
| N | 211 |
| Median | 1 |

| | | |
|---|---|---|
| 100.0% | maximum | 100.0% |
| 99.5% | | 100.0% |
| 97.5% | | 100.0% |
| 90.0% | | 100.0% |
| 75.0% | quartile | 100.0% |
| 50.0% | median | 100.0% |
| 25.0% | quartile | 50.0% |
| 10.0% | | 0.0% |
| 2.5% | | 0.0% |
| 0.5% | | 0.0% |
| 0.0% | minimum | 0.0% |

| | |
|---|---|
| Mode | 1 |

Figure 5. Distribution of Proportion of founders present 2 years after acquisition



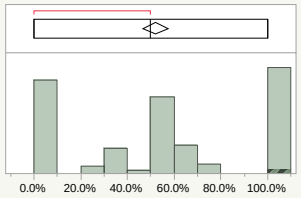

| | |
|---|---|
| Mean | 0.6588152 |
| Std Dev | 0.382107 |
| Std Err Mean | 0.0263053 |
| Upper 95% Mean | 0.7106715 |
| Lower 95% Mean | 0.6069588 |
| N | 211 |
| Median | 0.75 |
| Mode | 1 |

| | | |
|---|---|---|
| 100.0% | maximum | 100.0% |
| 99.5% | | 100.0% |
| 97.5% | | 100.0% |
| 90.0% | | 100.0% |
| 75.0% | quartile | 100.0% |
| 50.0% | median | 75.0% |
| 25.0% | quartile | 40.0% |
| 10.0% | | 0.0% |
| 2.5% | | 0.0% |
| 0.5% | | 0.0% |
| 0.0% | minimum | 0.0% |

Figure 6. Distribution of Proportion of founders present 3 years after acquisition

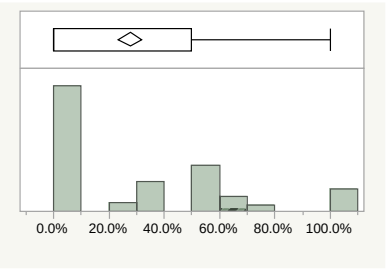
| | |
|---|---|
| Mean | 0.5209479 |
| Std Dev | 0.3896629 |
| Std Err Mean | 0.0268255 |
| Upper 95% Mean | 0.5738296 |
| Lower 95% Mean | 0.4680661 |

| | |
|---|---|
| N | 211 |
| Median | 0.5 |
| Mode | 1 |




| | | |
|---|---|---|
| 100.0% | maximum | 100.0% |
| 99.5% | | 100.0% |
| 97.5% | | 100.0% |
| 90.0% | | 100.0% |
| 75.0% | quartile | 100.0% |
| 50.0% | median | 50.0% |
| 25.0% | quartile | 0.0% |
| 10.0% | | 0.0% |
| 2.5% | | 0.0% |
| 0.5% | | 0.0% |
| 0.0% | minimum | 0.0% |

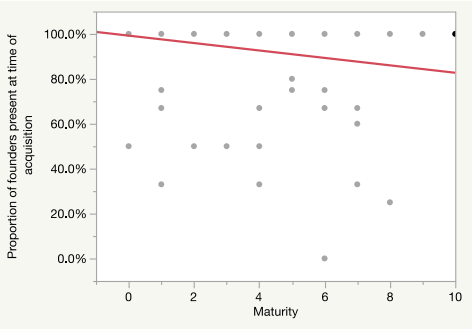
Figure 7. Distribution of Proportion of founders present 5 years after acquisition




| | |
|---|---|
| Mean | 0.2756872 |
| Std Dev | 0.326133 |
| Std Err Mean | 0.0224519 |
| Upper 95% Mean | 0.3199472 |
| Lower 95% Mean | 0.2314272 |
| N | 211 |
| Median | 0 |
| Mode | 0 |

| | | |
|---|---|---|
| 100.0% | maximum | 100.0% |
| 99.5% | | 100.0% |
| 97.5% | | 100.0% |
| 90.0% | | 75.0% |
| 75.0% | quartile | 50.0% |
| 50.0% | median | 0.0% |
| 25.0% | quartile | 0.0% |
| 10.0% | | 0.0% |
| 2.5% | | 0.0% |
| 0.5% | | 0.0% |
| 0.0% | minimum | 0.0% |

Figure 8. Bivariate Fit of Proportion of founders present at time of acquisition By Maturity (excluding outliers)




| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.1887 | -0.32038 | -0.04987 | 0.0081* |
| Covariance | -0.0815 | | | |
| Count | 196 | | | |

| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 3.418367 | 2.218447 |
| Proportion of founders present at time of acquisition | 0.935765 | 0.194691 |

Proportion of founders present at time of acquisition = 0.9923743 - 0.0165602*Maturity

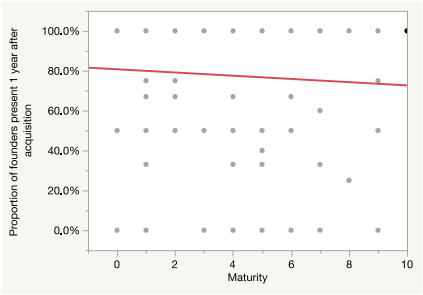
| | |
|---|---|
| RSquare | 0.035607 |
| RSquare Adj | 0.030636 |
| Root Mean Square Error | 0.191685 |
| Mean of Response | 0.935765 |
| Observations (or Sum Wgts) | 196 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.2631877 | 0.263188 | 7.1629 |

| | | | | |
|---|---|---|---|---|
| Error | 194 | 7.1281975 | 0.036743 | **Prob > F** |
| C. Total | 195 | 7.3913852 | | 0.0081* |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.9923743 | 0.025196 | 39.39 | <.0001* |
| Maturity | -0.01656 | 0.006188 | -2.68 | 0.0081* |

Figure 9. Bivariate Fit of Proportion of founders present 1 year after acquisition By Maturity (excluding outliers)




Proportion of founders present 1 year after acquisition = 0.8071239 - 0.008084*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.05425 | -0.19293 | 0.086563 | 0.4501 |
| Covariance | -0.03979 | | | |
| Count | 196 | | | |

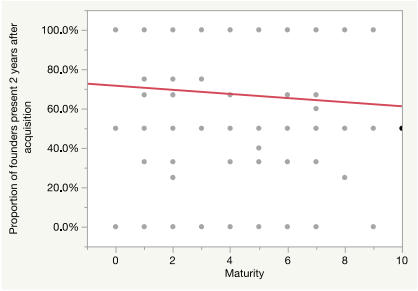
| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 3.418367 | 2.218447 |
| Proportion of founders present 1 year after acquisition | 0.77949 | 0.330592 |

| | |
|---|---|
| RSquare | 0.002943 |
| RSquare Adj | -0.0022 |
| Root Mean Square Error | 0.330955 |
| Mean of Response | 0.77949 |
| Observations (or Sum Wgts) | 196 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.062717 | 0.062717 | 0.5726 |
| Error | 194 | 21.249032 | 0.109531 | **Prob > F** |
| C. Total | 195 | 21.311749 | | 0.4501 |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.8071239 | 0.043503 | 18.55 | <.0001* |
| Maturity | -0.008084 | 0.010683 | -0.76 | 0.4501 |

Figure 10. Bivariate Fit of Proportion of founders present 2 years after acquisition By Maturity (excluding outliers)




Proportion of founders present 2 years after acquisition = 0.7161164 - 0.0104609*Maturity

| | |
|---|---|
| RSquare | 0.003847 |
| RSquare Adj | -0.00129 |
| Root Mean Square Error | 0.374404 |
| Mean of Response | 0.680357 |
| Observations (or Sum Wgts) | 196 |

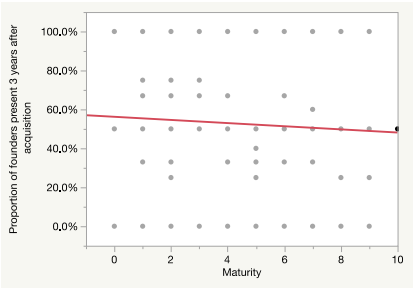
| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.105020 | 0.105020 | 0.7492 |
| Error | 194 | 27.194655 | 0.140179 | **Prob > F** |
| C. Total | 195 | 27.299675 | | 0.3878 |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.06202 | -0.20043 | 0.078814 | 0.3878 |
| Covariance | -0.05148 | | | |
| Count | 196 | | | |

| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 3.418367 | 2.218447 |
| Proportion of founders present 2 years after acquisition | 0.680357 | 0.374164 |

Figure 11. Bivariate Fit of Proportion of founders present 3 years after acquisition By Maturity (excluding outliers)




Proportion of founders present 3 years after acquisition = 0.5620883 - 0.0080736*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.0463 | -0.18525 | 0.094471 | 0.5194 |
| Covariance | -0.03973 | | | |
| Count | 196 | | | |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|

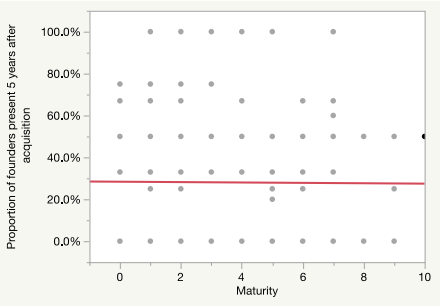
| | | | | |
|---|---|---|---|---|
| Intercept | 0.5620883 | 0.050931 | 11.04 | <.0001* |
| Maturity | -0.008074 | 0.012507 | -0.65 | 0.5194 |

| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 3.418367 | 2.218447 |
| Proportion of founders present 3 years after acquisition | 0.53449 | 0.386884 |

| | |
|---|---|
| RSquare | 0.002143 |
| RSquare Adj | -0.003 |
| Root Mean Square Error | 0.387464 |
| Mean of Response | 0.53449 |
| Observations (or Sum Wgts) | 196 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.062555 | 0.062555 | 0.4167 |
| Error | 194 | 29.124894 | 0.150128 | **Prob > F** |
| C. Total | 195 | 29.187449 | | 0.5194 |

Figure 12. Bivariate Fit of Proportion of founders present 5 years after acquisition By Maturity (excluding outliers)




Proportion of founders present 5 years after acquisition = 0.2838134 - 0.0009215*Maturity

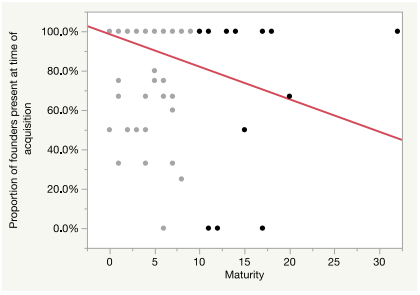
| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.00623 | -0.14626 | 0.134035 | 0.9309 |
| Covariance | -0.00454 | | | |
| Count | 196 | | | |

| | | | Mean | Std Dev |
|---|---|---|---|---|
| RSquare | 3.887e-5 | | | |
| RSquare Adj | -0.00512 | | 3.418367 | 2.218447 |
| Root Mean Square Error | 0.328735 | | 0.280663 | 0.327898 |
| Mean of Response | 0.280663 | | | |
| Observations (or Sum Wgts) | 196 | | | |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.000815 | 0.000815 | 0.0075 |
| Error | 194 | 20.964999 | 0.108067 | **Prob > F** |
| C. Total | 195 | 20.965814 | | 0.9309 |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.2838134 | 0.043211 | 6.57 | <.0001* |
| Maturity | -0.000922 | 0.010612 | -0.09 | 0.9309 |

Figure 13. Bivariate Fit of Proportion of founders present at time of acquisition By Maturity (including outliers)




Proportion of founders present at time of acquisition = 0.9855303 - 0.0165372*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.28433 | -0.40389 | -0.15523 | <.0001* |
| Covariance | -0.26276 | | | |
| Count | 211 | | | |

| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 4.260664 | 3.986085 |
| Proportion of founders present at time of acquisition | 0.915071 | 0.231836 |

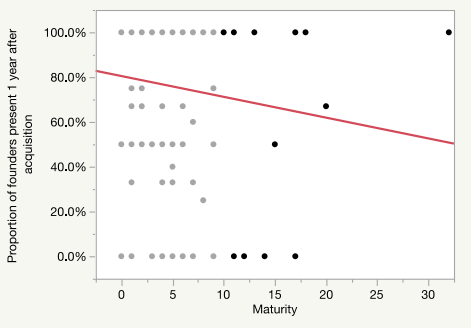
| | |
|---|---|
| RSquare | 0.080845 |
| RSquare Adj | 0.076447 |

| | |
|---|---|
| Root Mean Square Error | 0.222798 |
| Mean of Response | 0.915071 |
| Observations (or Sum Wgts) | 211 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.912502 | 0.912502 | 18.3827 |
| Error | 209 | 10.374572 | 0.049639 | **Prob > F** |
| C. Total | 210 | 11.287074 | | <.0001* |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.9855303 | 0.022479 | 43.84 | <.0001* |
| Maturity | -0.016537 | 0.003857 | -4.29 | <.0001* |

Figure 14. Bivariate Fit of Proportion of founders present 1 year after acquisition By Maturity (including outliers)



Proportion of founders present 1 year after acquisition = 0.8047302 - 0.009286*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.10768 | -0.23927 | 0.027795 | 0.1189 |
| Covariance | -0.14754 | | | |
| Count | 211 | | | |

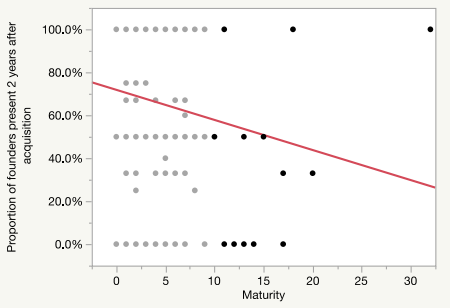
| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 4.260664 | 3.986085 |
| Proportion of founders present 1 year after acquisition | 0.765166 | 0.343754 |

| | |
|---|---|
| RSquare | 0.011594 |
| RSquare Adj | 0.006865 |
| Root Mean Square Error | 0.342572 |
| Mean of Response | 0.765166 |
| Observations (or Sum Wgts) | 211 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.287717 | 0.287717 | 2.4517 |
| Error | 209 | 24.527352 | 0.117356 | **Prob > F** |
| C. Total | 210 | 24.815069 | | 0.1189 |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.8047302 | 0.034564 | 23.28 | <.0001* |
| Maturity | -0.009286 | 0.005931 | -1.57 | 0.1189 |

Figure 15. Bivariate Fit of Proportion of founders present 2 years after acquisition By Maturity (including outliers)




Proportion of founders present 2 years after acquisition = 0.7185303 - 0.0140154*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.14621 | -0.27583 | -0.01136 | 0.0338* |
| Covariance | -0.22269 | | | |
| Count | 211 | | | |

| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 4.260664 | 3.986085 |
| Proportion of founders present 2 years after acquisition | 0.658815 | 0.382107 |

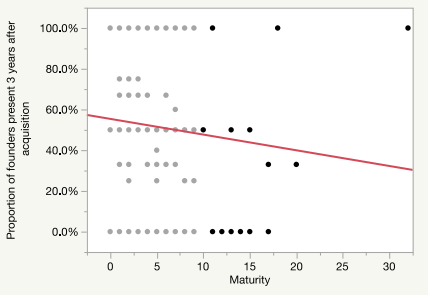
| | |
|---|---|
| RSquare | 0.021377 |
| RSquare Adj | 0.016694 |
| Root Mean Square Error | 0.378904 |
| Mean of Response | 0.658815 |
| Observations (or Sum Wgts) | 211 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.655430 | 0.655430 | 4.5653 |
| Error | 209 | 30.005774 | 0.143568 | **Prob > F** |

| | | | | |
|---|---|---|---|---|
| C. Total | 210 | 30.661204 | | 0.0338* |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.7185303 | 0.03823 | 18.80 | <.0001* |
| Maturity | -0.014015 | 0.00656 | -2.14 | 0.0338* |

Figure 16. Bivariate Fit of Proportion of founders present 3 years after acquisition By Maturity (including outliers)




Proportion of founders present 3 years after acquisition = 0.5538441 - 0.0077209*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.07898 | -0.21179 | 0.056692 | 0.2534 |
| Covariance | -0.12268 | | | |
| Count | 211 | | | |

| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 4.260664 | 3.986085 |
| Proportion of founders present 3 years after acquisition | 0.520948 | 0.389663 |

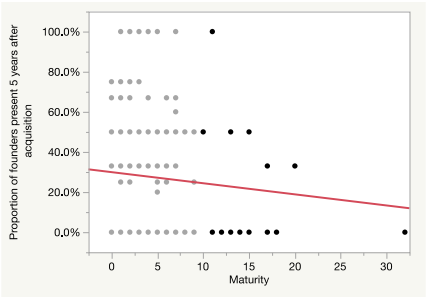
| | |
|---|---|
| RSquare | 0.006238 |

| | |
|---|---|
| RSquare Adj | 0.001483 |
| Root Mean Square Error | 0.389374 |
| Mean of Response | 0.520948 |
| Observations (or Sum Wgts) | 211 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.198908 | 0.198908 | 1.3120 |
| Error | 209 | 31.686903 | 0.151612 | **Prob > F** |
| C. Total | 210 | 31.885810 | | 0.2534 |


| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.198908 | 0.198908 | 1.3120 |
| Error | 209 | 31.686903 | 0.151612 | **Prob > F** |
| C. Total | 210 | 31.885810 | | 0.2534 |


Figure 17. Bivariate Fit of Proportion of founders present 5 years after acquisition By Maturity (including outliers)




Proportion of founders present 5 years after acquisition = 0.2992755 - 0.0055363*Maturity

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.06767 | -0.2009 | 0.068024 | 0.3280 |
| Covariance | -0.08797 | | | |
| Count | 211 | | | |

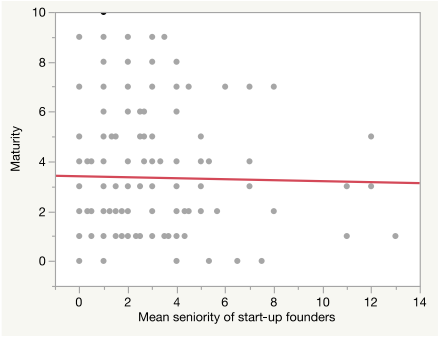
| Variable | Mean | Std Dev |
|---|---|---|
| Maturity | 4.260664 | 3.986085 |
| Proportion of founders present 5 years after acquisition | 0.275687 | 0.326133 |

| | |
|---|---|
| RSquare | 0.004579 |
| RSquare Adj | -0.00018 |
| Root Mean Square Error | 0.326163 |
| Mean of Response | 0.275687 |
| Observations (or Sum Wgts) | 211 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.102271 | 0.102271 | 0.9614 |
| Error | 209 | 22.233904 | 0.106382 | **Prob > F** |
| C. Total | 210 | 22.336175 | | 0.3280 |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 0.2992755 | 0.032908 | 9.09 | <.0001* |
| Maturity | -0.005536 | 0.005646 | -0.98 | 0.3280 |

Figure 18. Bivariate Fit of Maturity By Mean seniority of start-up founders




Maturity = 3.3993721 - 0.0196433*Mean seniority of start-up founders

| | Value | Lower 95% | Upper 95% | Signif. Prob |
|---|---|---|---|---|
| Correlation | -0.02136 | -0.16359 | 0.12174 | 0.7705 |
| Covariance | -0.11352 | | | |
| Count | 189 | | | |

| Variable | Mean | Std Dev |
|---|---|---|
| Mean seniority of start-up founders | 2.823192 | 2.403918 |
| Maturity | 3.418367 | 2.218447 |

| | |
|---|---|
| RSquare | 0.000456 |
| RSquare Adj | -0.00489 |
| Root Mean Square Error | 2.21592 |
| Mean of Response | 3.343915 |
| Observations (or Sum Wgts) | 189 |

| Source | DF | Sum of Squares | Mean Square | F Ratio |
|---|---|---|---|---|
| Model | 1 | 0.41920 | 0.41920 | 0.0854 |
| Error | 187 | 918.22630 | 4.91030 | **Prob > F** |

| | | | | |
|---|---|---|---|---|
| C. Total | 188 | 918.64550 | | 0.7705 |

| Term | Estimate | Std Error | t Ratio | Prob>\|t\| |
|---|---|---|---|---|
| Intercept | 3.3993721 | 0.249007 | 13.65 | <.0001* |
| Mean seniority of start-up founders | -0.019643 | 0.067229 | -0.29 | 0.7705 |