Online-Journals.org

iJEP International Journal of Engineering Pedagogy

iJEP | eISSN: 2192-4880 | Vol. 14 No. 8 (2024) | OPEN ACCESS

https://doi.org/10.3991/ijep.v14i8.48959

PAPER

Enhancing Professional Employability: The Impact of Agile Methodology Training

Rodrigo A. Crisostomo[1](✉), Nicolas A. Nunez[2,3], Giuliano Lopez-Burga[4]

[1]Facultad de Ingeniería y Empresa, Universidad Católica Silva Henriquez, Santiago, Chile

[2]CENTRUM Católica Graduate Business School, Lima, Peru

[3]Pontificia Universidad Católica del Perú, Lima, Peru

[4]San Ignacio de Loyola – Escuela Isil, Lima, Peru

rcrisostomoz@ucsh.cl

ABSTRACT

In today's rapidly evolving business landscape, Agile methodologies have emerged as a crucial approach for organizations to remain competitive and responsive to change. Despite the growing adoption of Agile frameworks, there is a lack of quantitative research examining the impact of Agile certifications on individual career trajectories. This study aims to bridge this gap by investigating the relationship between acquiring Agile certifications and career outcomes, specifically focusing on professionals from business administration (BA) and computer science (CS) backgrounds. Employing survival analysis (SA), particularly the Kaplan-Meier method, we assess the temporal dynamics of career advancement events, including job promotions, job transitions, and changes in job responsibilities. Our findings reveal that the most prevalent career advancement is promotion, occurring on average after 1,102.98 days, while the average time for observing at least one career effect is 733.37 days. The study also identifies scrum master and product owner as the most sought-after Agile certifications. These results contribute to the understanding of how Agile methodologies influence career progression and provide valuable insights for professionals, employers, and educational institutions navigating the dynamic landscape of Agile adoption. The findings underscore the importance of Agile certifications in fostering career growth and adaptation to the evolving demands of the industry.

KEYWORDS

survival analysis (SA), Kaplan Meier method, scrum; computer sciences (CS), business administration (BA), professional career

1 INTRODUCTION

In today's rapidly evolving and increasingly complex business landscape, organizational agility has emerged as a critical factor for success and competitiveness. Agile methodologies, originally conceived for software development, have become a fundamental approach for organizations to remain competitive and responsive to change in a variety of industries.

Crisostomo, R.A., Nunez, N.A., Lopez-Burga, G. (2024). Enhancing Professional Employability: The Impact of Agile Methodology Training. *International Journal of Engineering Pedagogy (iJEP)*, 14(8), pp. 40–56. https://doi.org/10.3991/ijep.v14i8.48959

Article submitted 2024-03-05. Revision uploaded 2024-09-26. Final acceptance 2024-09-26.

Agility, understood as a common efficiency-oriented framework, finds application in multiple fields, from Agile methodologies in information technologies (IT) to Agile manufacturing. Touahmia [1] points out that, in the information economy, professional training is essential to ensure both individual and organizational competitiveness, enabling rapid technical improvements and meeting changing industry demands.

Corporations are increasingly adopting business agility frameworks, demonstrating their relevance in coordinating strategy and operations, according to Zhang [2]. Serrador [3] highlights how Agile methodologies benefit organizations by enabling them to cope with uncertain environments, developing the ability to respond to changes and seize them as opportunities. This application extends beyond the IT field, as demonstrated by Zastempowski [4] in the context of Agile manufacturing.

The implementation of agility enables organizations to achieve a balance between effectiveness and efficiency, as demonstrated by Gligor [5]. They can be achieved within an Agile framework through several key approaches. For instance, flexibility and adaptability allow for quick adjustments to changing environments, keeping cost structure under control by optimizing time and resources. Also, customer-centric focus ensures that delivered products and services meet market needs more effectively, increasing profits. Additionally, collaboration and open communication foster alignment across teams, driving more effective project execution and reducing costs for modifying requirements. Thus, organizational strategic goals are achieved in an Agile framework driven by these factors. However, Kahl [6] stresses that this organizational agility requires an alignment of skills at all levels.

Despite the growing adoption of Agile frameworks, Matharu et al. [7] point out that there is little evidence to evaluate the effect of agility training at the individual level. This study gap is particularly relevant considering that, according to Setiawati [8], business agility is the ability of a company to adjust and react quickly to changes in the business environment.

The adoption of Agile methodologies is not without challenges. Singh [9] describes agility as a methodology based on smarter and faster operating principles and techniques that provide quick responses and flexibility to change in technology projects. However, Wonohardjo and Sunaryo [10] point out that while methodologies such as Scrum can generate more innovative ideas and a productive workplace, there is still a need to evaluate how training affects the career paths of business professionals.

Previous studies have investigated the impact of Agile methodologies on job outcomes at the individual level. For example, Sun and Schmidt [11] found that practitioners' use of Agile methodologies was positively associated with job satisfaction and perceived productivity. This finding is supported by several other studies [12–16], which collectively provide substantial evidence of the benefits of Agile practices for practitioners in various aspects of their work.

In addition, the theory of rapid skill obsolescence proposed by Chen et al. [17] suggests that individuals should experience faster career progression because of their upgraded skills. This is particularly relevant in the context of Agile certifications, where waiting years for a promotion after acquiring such certifications could be considered too long, given the pace at which new methodologies, frameworks, and tools emerge.

In this context, our study seeks to fill an important gap in the literature by quantitatively examining the impact of certifications in Agile methodologies on individual career paths. We focus specifically on professionals with backgrounds in business administration (BA) and computer science (CS), using survival analysis (SA), particularly the Kaplan-Meier method, to assess the temporal dynamics of career advancement events.

This study will not only contribute to the understanding of how Agile methodologies influence career progression but will also provide valuable information for practitioners, employers, and educational institutions navigating the dynamic landscape of Agile adoption. The results of this study have the potential to inform professional development strategies and organizational policies in the era of enterprise agility.

2 MATERIALS AND METHODS

2.1 Model conceptualization

This section outlines the steps involved in constructing the analytical model for the study. SA is employed as a quantitative approach, utilized across various domains, particularly in tracking event occurrences. SA holds significant utility in predictive modeling contexts, as elucidated by Papathanasiou [18]. For instance, SA finds application in predicting machine breakdowns, as underscored by Durczak [19], and extends to diverse fields such as the evaluation of agricultural machinery dependability.

Numerous methodological techniques exist within the realm of SA, each warranting examination to ascertain alignment with the study's objectives. Notable approaches include the Kaplan-Meier method, introduced in 1958 [20], the Cox Hazard method depicted by Deo [21], and the Weibull distribution method, by Zhang [22]. Given its inherent compatibility with the primary objective of assessing temporal associations with the emergence of labor-related outcomes, the Kaplan-Meier method is selected for this investigation. The utilization of survival probability in relation to time is deemed most suitable within the conceptual framework of the study.

To assess the impact of certifications in Agile methodologies on career paths, three key outcomes were selected: promotions, obtaining a new job, and changes in job description. These outcomes were chosen based on existing literature that identifies them as significant milestones in individual career development.

Promotions have been widely recognized as a crucial indicator of career advancement. Ng et al. [16] identified promotions as one of the main factors contributing to objective career success. In the context of Agile methodologies, Tripp et al. [23] noted that adoption of agile practices can lead to increased job satisfaction and potential promotion opportunities.

Obtaining a new job is another important indicator of career advancement, especially in the rapidly evolving technology field. Fernandez and Fernandez [15] highlighted that organizational agility requires professionals with updated skills, which can lead to new job opportunities for those with relevant Agile certifications.

Job description changes are particularly relevant in Agile environments. Conboy et al. [14] argued that roles in Agile teams are more fluid and adaptable, which can result in significant changes in job responsibilities. In addition, Law and Lárusdóttir [24] demonstrated how the adoption of Agile methodologies can transform existing roles, particularly in user experience design.

Collectively, these three career outcomes provide a comprehensive view of how certifications in Agile methodologies can influence various aspects of an individual's career path. By examining these three milestones, our study seeks to capture a complete picture of the impact of Agile certifications on professional development.

To model the expected time of labor effects, we present a vector with three dimensions C_1, C_2, and C_3, where each person *i* gets:

$$E_i = \overrightarrow{C_i} = (C_{1i}\, C_{2i}\, C_{3i})$$

- C_{1i}: Component linked to the event of being promoted.
- C_{2i}: Component linked to the event of finding a new job.
- C_{3i}: Component linked to the change of a job description.

This conceptual approach is taken to a concrete context, defining for the use of SA two kinds of variables, first the one related to the happening of the three events described previously (x_{ki}; k = 1, 2, 3) On the other hand, it is possible to define variables related to the time when events happen (t_{ki}; k = 1, 2, 3), This way, it is possible to get the number of days elapsed from the obtention of the first certification (t_{0i}) and the occurrence of a determined effect (t_{ki}) by substracting them (t_{ki}–t_{0i}). The details of these variables will be treated in depth in the following lines. This way, the rest of the variables used in the model (see Appendix, Table A1) can be considered segmentation variables; while x_{ki} and (t_{ki}–t_{0i}) are specific input for SA model.

Regarding the tools required for the study, SA will be used as the supporting statistical method, which takes its name due to the fact that, in the beginning, it was used to analyze survival time for patients undergoing different kinds of diseases, however, in our study it will be used to analyze time measured since the obtaining of a certification to the time when one of the described effects above C_1, C_2, or C_3 is detected.

So, we define the following variables for the model that represent the occurrence of a particular labor effect, where suffix 1 denotes promotion, 2 denotes getting a new job, and 3 denotes a change in job description; suffix *i* refers to individual *i*:

$$x_{1i} = \{1 \textit{ in case } C_1 \textit{ event happens to individual } i \; 0 \textit{ otherwise, event censored}$$
$$x_{2i} = \{1 \textit{ in case } C_2 \textit{ event happens to individual } i \; 0 \textit{ otherwise, event censored}$$
$$x_{3i} = \{1 \textit{ in case } C_3 \textit{ event happens to individual } i \; 0 \textit{ otherwise, event censored}$$

Then, we can retrieve date data from a set of 31 workers who got at least one certification. This way, is recorded the date when the first certification was obtained, named as t_{0i}. Besides, and we can tabulate dates of events as it follows:

$$t_{1i} = \{\textit{Happening of the event } x_{1i} \textit{ when } x_{1i} = 1$$
$$\textit{End of the study otherwise when } x_{1i} = 0$$

$$t_{2i} = \{\textit{Happening of the event } x_{2i} \textit{ when } x_{2i} = 1$$
$$\textit{End of the study otherwise when } x_{2i} = 0$$

$$t_{3i} = \{\textit{Happening of the event } x_{3i} \textit{ when } x_{3i} = 1$$
$$\textit{End of the study otherwise when } x_{3i} = 0$$

In this manner, the instantiation of the following variables can be formulated in accordance with the theoretical model expounded.

Set $X(\overrightarrow{x})$: Binary variables that reflect the labor impact linked to certifications:

$$X_{PROM} = x_{1i} \tag{1}$$

$$X_{NJOB} = x_{2i} \tag{2}$$

$$X_{SHIFT} = x_{3i} \tag{3}$$

$$X_{EFFECT} = Max\ \{x_{1i}, x_{2i}, x_{3i}\} \tag{4}$$

It is important to underline that (4) has the purpose of recording if at least one event has taken place during the timeframe of the study.

Set $T(\vec{t})$: Variables linked to dates that retrieve when events x_{ki} (k = 1, 2, 3) took place:

$$T_{PROM} = t_{1i} \tag{5}$$

$$T_{NJOB} = t_{2i} \tag{6}$$

$$T_{SHIFT} = t_{3i} \tag{7}$$

$$T_{EFFECT} = Min\ \{t_{1i}, t_{2i}, t_{3i}\} \tag{8}$$

Analogically, (8) has the purpose of recording the date when the first event came across.

Set $D(\vec{d})$: Integer variables linked to the time elapsed, in days, from the obtaining of the first certification t_{00i} until the time when a determined labor effect took place, calculating the number of days elapsed and subtracting t_{00i} from (5), (6), (7), and (8). This has the purpose of delivering time variables to the Kaplan Meier Model:

$$D_{NJOB} = T_{PROM} - t_{00i} \tag{9}$$

$$D_{NJOB} = T_{NJOB} - t_{00i} \tag{10}$$

$$D_{SHIFT} = T_{SHIFT} - t_{00i} \tag{11}$$

$$D_{EFFECT} = T_{EFFECT} - t_{00i} \tag{12}$$

It is crucial to keep in mind that, together with set X, the last declared set D is the most crucial input to execute the model; as a result, the T set acts as an intermediary resource before obtaining the D set.

2.2 Instrument design and structure (Poll)

An online poll was utilized to gather information about the variables defined in equations (1), (2), and (3) that were connected to the occurrence of labor-related events to obtain the necessary data input. However, variables related to the time of occurrence were retrieved and reprocessed for the model in accordance with equations (5), (6), and (7) to compute (9), (10), and (11).

The variables related to combined effects that are mentioned in (4), (8), and (12) were given special consideration. Therefore, the variables linked to events (1) through (4) and times of occurrence (9) through (12) can be used as inputs to run the Kaplan Meier model.

In this section, the set of questions applied to the universe of professionals who participated in the study were the ones depicted in Table 1.

Table 1. Questions contained in the poll to retrieve data from the individuals of the sample in the study

ID Question	Question Description	Category
1	Gender	Basic and academic segmentation
2	Age	
3	Profession	
4	Country of origin	
5	Have you completed any postgraduate studies?	Academic background segmentation
6	What certifications have you completed at your training center?	Agile certifications segmentation
7	Indicate the date of the first certification obtained at your training center?	Date; start timestamp for all effects
8	Have you had any job promotion (promotion or change in functions) that can be attributed to the certification obtained?	Binary variable that indicates the occurrence of the event
9	If the previous answer is affirmative, when did it happen?	Date; end timestamp for previous effect
10	Have you found work in any position/role related to the certification obtained?	Binary variable that indicates the occurrence of the event
11	If the previous answer is affirmative, when did it happen?	Date; end timestamp for previous effect
12	Have you had any change in responsibilities or functions in the work context attributable to the certification obtained?	Binary variable that indicates the occurrence of the event
13	If the previous answer is affirmative, when did it happen?	Date; end timestamp for previous effect

The sample is mostly composed of engineers (96.8%), most of them are specialized in management and industrial engineering (61.3%). The rest of the sample is composed by CS professionals (32.3%), electrical engineering (3.2%) while the remaining participant is a designer (3.2%). 67.7% of the participants come from Chile, while 32.3% come from other Latin American countries. Regarding the age of the participants, the sample is composed of two individuals younger than 30 years (6.5%), five between 31 and 35 years (16.1%), 12 between 36 and 40 years (38.6%), six are between 41 and 45 years (19.4%), and the remaining six participants are older than 45 years (19.4%).

2.3 Kaplan Meier model background

The Kaplan Meier method was selected among the SA techniques because of its unique features, particularly in relation to its advantages, as this study found, in situations where data were censored, meaning that events were not observed to occur within the study's timeframe. Additionally, by using the accompanying plots, this method provides a visual estimate of the survival function over time. It is also important to consider the fact that this method is helpful in situations where distribution information is not provided ex ante because it does not require any assumptions regarding the survival time distribution.

3 RESULTS AND DISCUSSION

This section presents the findings from our analysis of the impact of Agile methodology certifications on career trajectories, using the Kaplan-Meier method for SA. As shown in Table 2, our study reveals that the most significant career advancement associated with Agile certifications is job promotion. The certifications for scrum master and product owner emerged as the most sought-after, highlighting their value in the labor market. Furthermore, the data suggest potential differences in the impact of Agile certifications based on educational background and industry sector, emphasizing the need for future research in these areas. These results underscore the importance of Agile certifications in fostering career growth and adapting to industry demands.

Table 2. Summary of times associated to variables from Kaplan Meier model

Variable Concept C_i	Variable Name	Mean (Days)	Std. Dev. (Days)	Proportion (%)
Promotion	D_PROM	1102.98	124.23	38.71
New job	D_NJOB	1298.95	110.13	25.81
Change of job description	D_SHIFT	1127.48	106.80	35.48
Combined effect	D_EFFECT	733.37	94.91	67.74

The most rapid labor effect to manifest is associated with the combined effect of various job changes, which occurs on average in 733.37 days and is the most frequently observed effect (67.74%). This can be attributed to the inherent nature of Agile methodologies, which prioritize adaptability and flexibility within job roles, as Sun and Schmidt suggest [11]. Agile practices encourage continuous learning, iterative improvements, and frequent adjustments to workflows and responsibilities. This dynamic approach allows professionals to quickly adapt to new roles and responsibilities, leading to more frequent job changes. Furthermore, Agile frameworks promote cross-functional collaboration and skill development, enabling individuals to take on diverse tasks and roles within their organizations. Consequently, the skills developed through Agile certifications equip professionals with the skills needed to navigate and excel in a rapidly changing work environment, resulting in a higher frequency of job changes observed in this study, according to Sun and Schmidt [11] and Allen [25].

Meanwhile, finding a new job is linked to the longest average time. The reason for this could be that most respondents to the poll were employed by a company at the time, and having a certain certification had no bearing on whether they were hired by that company or not. This could be complemented by findings made by Chen et al.'s [17].

In terms of individual labor impacts, it can be observed that the labor effect associated with promotions occurs more quickly, as seen in Table 2 by comparing means. On the other hand, Figure 2 illustrates a situation in which it is impossible to calculate the appropriate median because more than 50% of cases remain unaffected at the conclusion of the observed time. This finding suggests that job description modifications and promotions occur earlier and more frequently than finding a new job. There are discernible changes in the dynamics of these labor effects based on the increased frequency and temporal precedence of promotions and role alterations in comparison to job searches.

Figure 1 illustrates the survival function for the time until promotion after obtaining an Agile certification, showing a gradual decline that indicates the promotions

happen steadily over time, with an average of 1102.98 days. This figure reinforces the finding that Agile certifications can accelerate career advancement, particularly in terms of promotions, underscoring the value of such certifications for career growth.

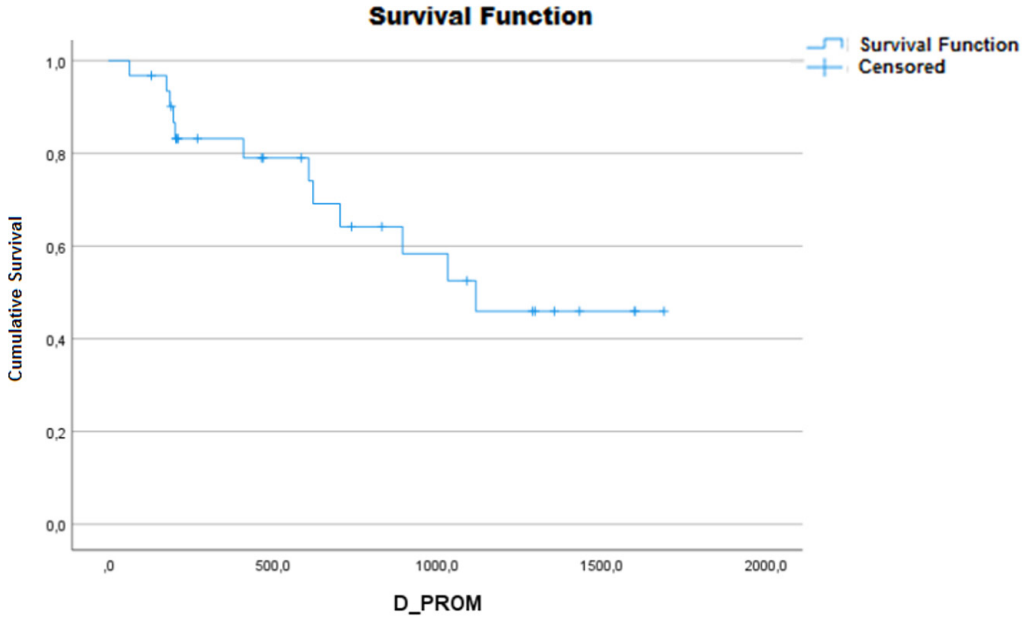

Fig. 1. Survival function for variable D_PROM plot

As seen previously in Table 2, the variable associated with finding a new job is a slower behavior to contribute to an individuals' career. In Figure 2. Showing the corresponding effects makes it possible to view the evolution of population. Since more than half of the population does not have an impact on finding a new job at the end of the study, it is reasonable to conclude that these are the slowest effects because they have a median that cannot be computed.

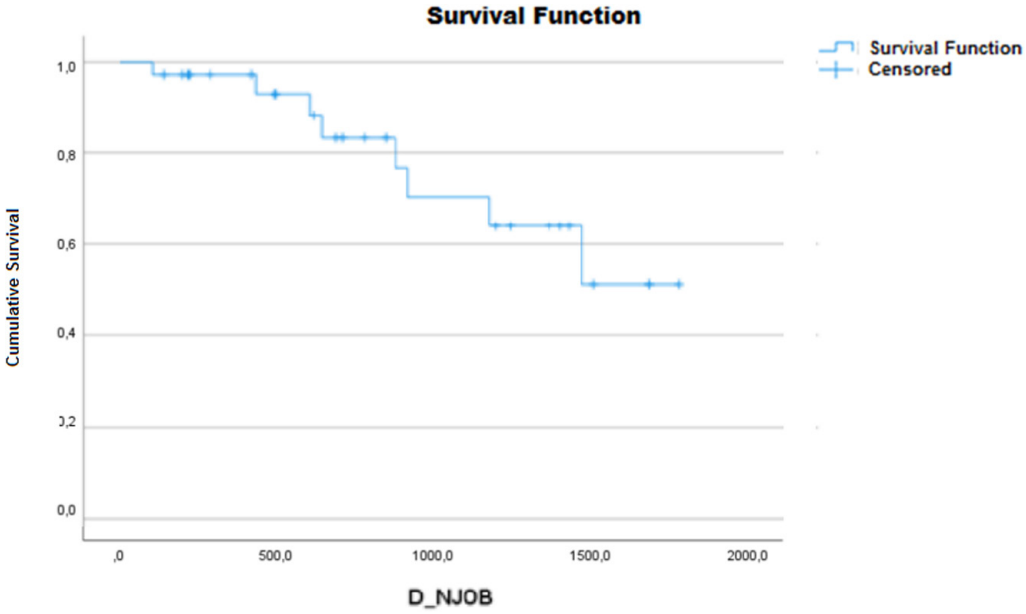

Fig. 2. Survival function for variable D_NJOB plot

Figure 3 displays the survival function for securing a new job following an Agile certification. The slower decline in the curve highlights that this career effect takes longer to manifest, with an average of 1298.95 days. While certifications are valuable for internal career advancement, they have a slower impact on external job opportunities.

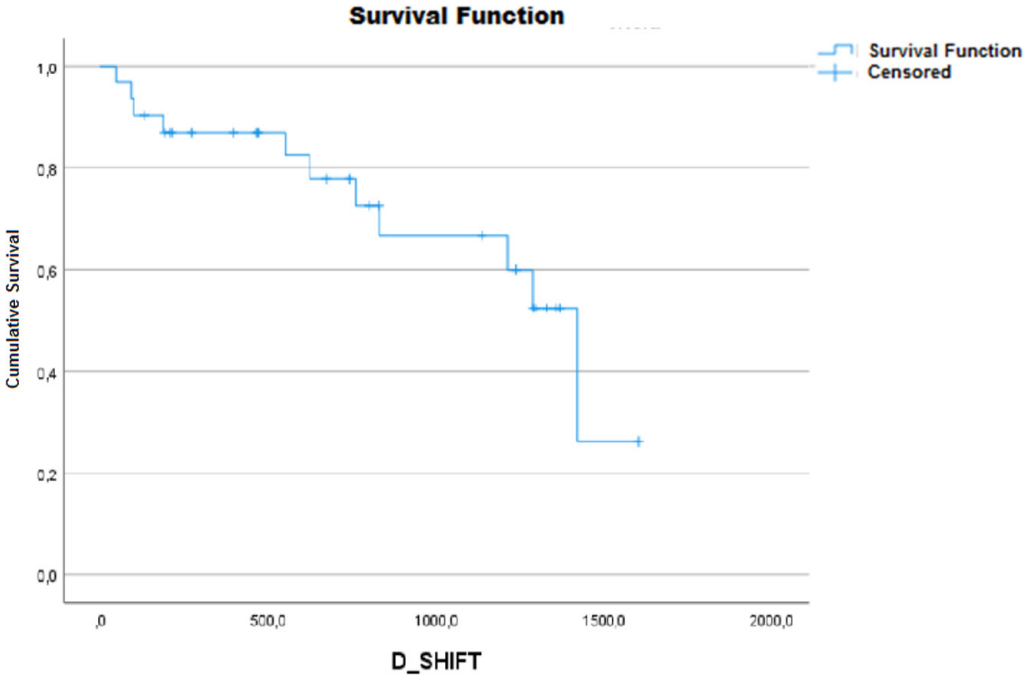

Fig. 3. Survival function for variable D_SHIFT plot

This distinction made between C_2 and C_1 with C_3 is crucial because individuals who are already employed have more immediate opportunities for career advancement within their current organization. Promotions and changes in job descriptions are more likely to occur for these individuals as they continue to demonstrate their skills and capabilities, often enhanced by their Agile certifications. This is aligned with Farberman et al. [26] when job searches among employed and unemployed are analyzed. On the other hand, individuals who are not employed at the time of the study may face a longer timeline before experiencing similar labor effects, as they first need to secure employment before progressing to stages of promotion or job description changes. This explains why promotions and job description changes are observed more quickly among those already employed, reflecting a progression within their current career path facilitated by the Agile methodologies they practice, giving more possibilities as the ones expounded by Chen et al. [17].

Figure 4 shows the survival function for changes in job description after the certification. In this case, the curve reveals a relatively faster occurrence of this effect, with an average time of 1127.48 days. This figure highlights the adaptability and role flexibility that Agile certifications can stimulate, leading to rapid changes in job responsibilities within organizations.

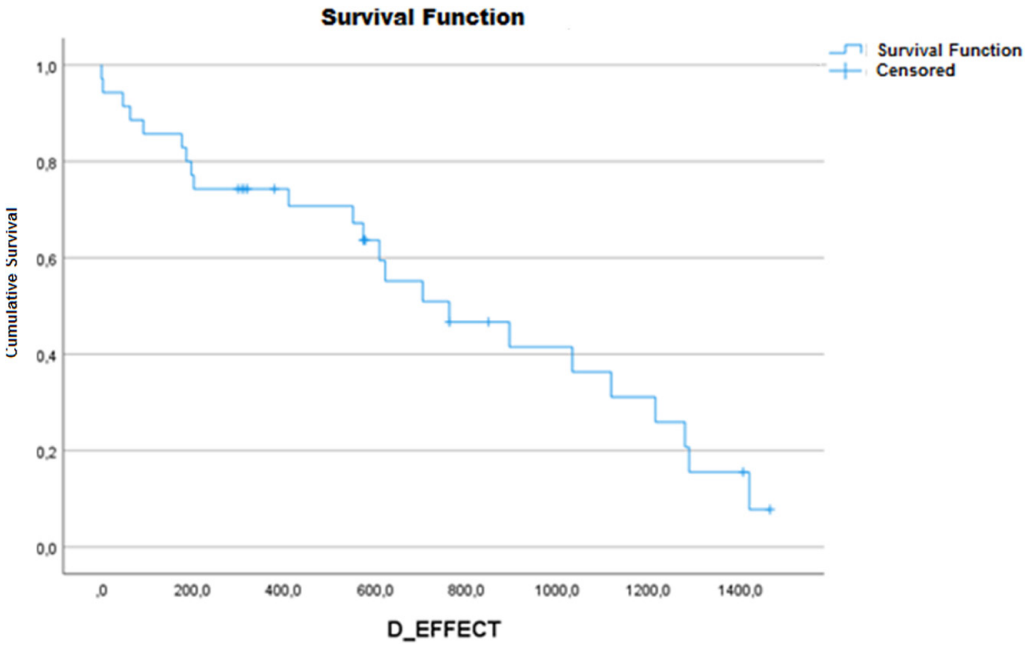

Fig. 4. Survival function for variable D_EFFECT plot

Previous claims imply that Agile methodologies can help professionals advance their careers; however, there is no proof that using Agile methodologies will help one land a new position. Nevertheless, it is evident that the survival function curves linked to C_1 and C_3 decrease more quickly than those related to C_2 (that is, C_1 and C_3 events happen faster than C_2). This demonstrates a crucial point: among those who are working at the time of the study, the labor effect manifests itself more quickly.

The most demanded certifications in the study are scrum master and product owner, as shown in Table 3, which is consistent with other studies made where scrum master is referenced as a recurrent certification, such as Kadenic [27] and Montenegro [28]. These specific certifications are highly valued by employers due to several reasons. For example, the scrum master certification equips individuals with the skills to facilitate Agile practices within teams, ensuring that projects are completed efficiently and effectively. Scrum masters play a crucial role in removing impediments, fostering an environment conducive to high performance, and ensuring continuous improvement. Conversely, the product owner certification is highly regarded because it focuses on maximizing the value of the product resulting from the work of the development team. Product owners are responsible for defining the product vision, managing the product backlog, and prioritizing tasks to align with business goals. This role is critical in ensuring that the team delivers products that meet customer needs and drive business success. Both certifications emphasize leadership, strategic thinking, and a deep understanding of Agile principles, making individuals with these qualifications invaluable assets to organizations striving for agility and competitiveness in today's fast-paced market. Therefore, our results suggest that both certifications are the most demanded by the labor market, as obtaining them is seen by employees as a signal. The results are consistent with previous studies such as the one performed by Wonohardjo [10], and just as is shown by Hidayati [29], it is important to highlight that are the main roles in frameworks such as Scrum.

Table 3. Presence of certifications obtained by individuals in the study (Top 5)

Certification	Presence of Most Demanded Certifications in Sample (%)
Scrum Master	70.57
Product Owner	41.94
Management 3.0	25.81
Lean Management	25.81
Kanban Essentials	25.81

In terms of the composition of the sample, we see that the results of our study underscore the importance of leadership in fostering an Agile culture and facilitating career growth opportunities for professionals with Agile skills. As Mehta et al. [30] argue, leaders who embrace Agile principles and practices can effectively drive organizational change and improve team performance, creating an environment conducive to career advancement for professionals with Agile certifications.

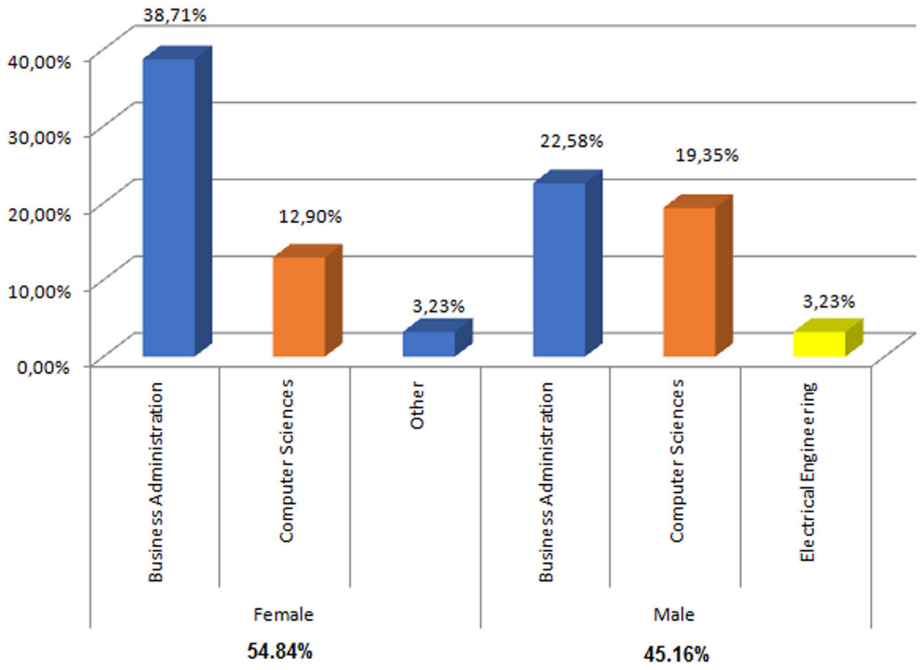

Fig. 5. Composition of poll universe according to sex and to kind of profession

According to Figure 5, women are disproportionately the ones having educational histories associated with BA programs. Men are more likely to enroll in undergraduate CS programs than women are, with BA coming second. This discrepancy in academic specializations illuminates the educational background distribution within the cohort under study in relation to gender, which advances our comprehension of the varied academic profiles of men and women. In fact, this has a correspondence with the findings within the study of Gunawan et al. [31], where the gender disparities in STEM careers are analyzed in both developed and developing countries.

Regarding the presence of graduate degrees, it is remarkable that most people who were part of this study have at least one (58.06%) as shown in Figure 6.

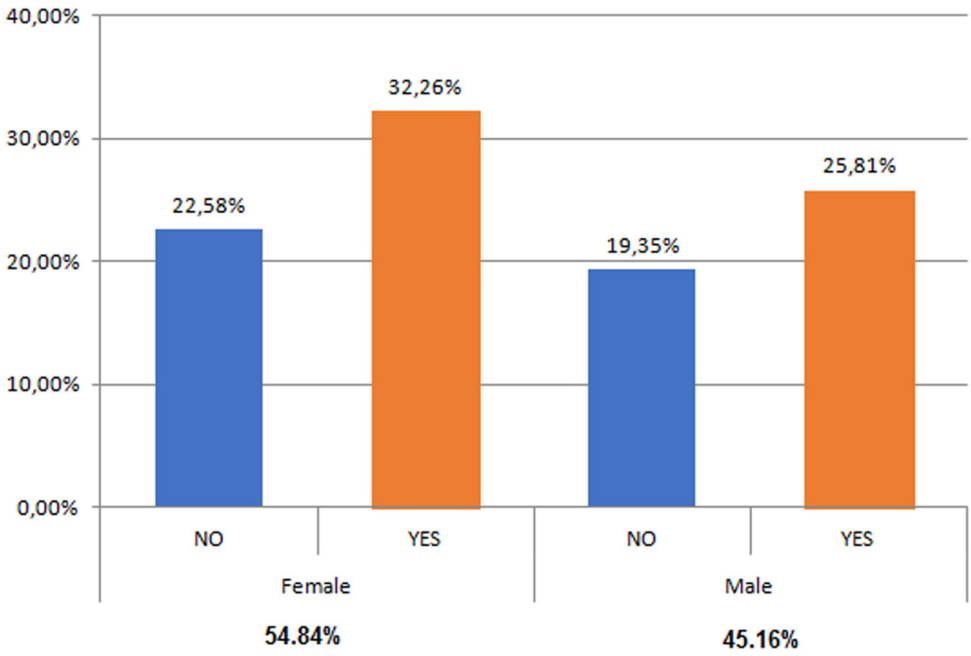

Fig. 6. Composition of the universe in terms of graduate level degree possession

Overall, these figures may open an opportunity window for engineering schools, to assess the convenience of including Agile certifications as part of their curricula, to improve their value for their students.

4 CONCLUSIONS

Our study aimed to investigate the impact of acquiring Agile methodology certifications on the career trajectories of professionals from BA and CS backgrounds. By employing SA, specifically the Kaplan-Meier method, we sought to provide quantitative evidence of the relationship between Agile certifications and career progression.

The findings of this study directly address the research objectives. First, we found that obtaining at least one Agile certification can significantly accelerate career advancement, particularly in terms of job promotions and changes in job responsibilities. The Kaplan-Meier analysis suggests that professionals who acquired Agile certifications experienced faster career progression compared to those without such certifications, which is supported by Beraza et al. [32]. Specifically, the most rapid labor effect was associated with the combined effect of various job changes, occurring on average in 733.37 days, followed by promotions (1102.98 days) and changes in job description (1127.48 days).

Our results show that scrum master and product owner certifications are the most valued by employers due to their relevance in the implementation of Agile methodologies and their applicability in various organizational settings. Although certifications have less impact on getting a new job, they promote job changes within organizations that already adopt Agile methodologies, where internal talent development is preferred. In addition, we observed differences in the impact by educational background and industry, with IT professionals moving up faster and those in BA experiencing more role changes. However, more research is needed to further explore these findings.

Regarding the limitations of the study, a bigger sample may ensure a higher level of generalizability. Another limitation of the study is related to the fact that we did not measure the salary increase due to privacy concerns from the participants of the study. In conclusion, in a broader context, our findings underscore the potential significance of certifications in Agile methodologies as catalytic elements in career progression. These certifications serve as valuable accreditations that can effectively showcase an individual's skills to recruiters and human resources teams. The results imply that individuals equipped with Agile methodologies certifications possess capabilities that are highly regarded in their respective professional fields.

In terms of further research, it is possible to affirm that while this study provides valuable insights into the short-term career impacts of Agile certifications, it should investigate the long-term effects on career progression. Longitudinal studies could help determine whether the observed benefits of Agile certifications persist over time and how they influence career trajectories in the long run. Additionally, future studies should explore the applicability of Agile methodologies and certifications in non-STEM fields. As Agile principles gain popularity across various industries, it would be valuable to examine how professionals in fields such as marketing, finance, and human resources can benefit from acquiring Agile certifications. Investigating the transferability of Agile skills and their impact on career outcomes in diverse professional contexts would provide a more comprehensive understanding of the value of Agile certifications in today's rapidly evolving job market.

Another interesting avenue is related to measuring the impact of certifications by analyzing some specific factors such as industrial sector (banking, IT, mining, and education among others) and job level (starter, intermediate, and manager) to establish the level of career development after getting an Agile certification.

In conclusion, this study provides empirical evidence supporting the value of Agile methodology certifications in fostering career growth and adaptation to the evolving demands of the industry. The findings offer valuable insights for professionals, employers, and educational institutions navigating the dynamic landscape of Agile adoption. By directly addressing the research objectives, this study contributes to a deeper understanding of the relationship between Agile certifications and career trajectories, paving the way for future research to build upon these findings and explore the long-term impacts and transferability of Agile skills across diverse professional domains.

5 REFERENCES

[1] M. Touahmia, M. Aichouni, A. Alghamdi, L. Kolsi, and H. Alzamil, "A foresight study about the skills and competencies needed for quality professionals in 2030: An empirical study of Saudi Arabia," *Engineering, Technology & Applied Science Research*, vol. 10, no. 5, pp. 6176–6182, 2020. https://doi.org/10.48084/etasr.3713

[2] Z. Zhang and H. Sharifi, "A methodology for achieving agility in manufacturing organizations," *International Journal of Operations & Production Management*, vol. 20, no. 4, pp. 496–513, 2000. https://doi.org/10.1108/01443570010314818

[3] P. Serrador and J. Pinto, "Does Agile work? — A quantitative analysis of agile project success," *International Journal of Project Management*, vol. 33, no. 5, pp. 1040–1051, 2015. https://doi.org/10.1016/j.ijproman.2015.01.006

[4] M. Zastempowski and S. Cyfert, "A new angle on SMEs' competitiveness. How do agility capabilities affect a firm's competitive position?" *Journal of Organizational Change Management*, vol. 36, no. 4, pp. 635–662, 2023. https://doi.org/10.1108/JOCM-09-2022-0255
[5] D. Gligor *et al.*, "The role of supply chain agility in achieving supply chain fit," *Decision Sciences*, vol. 47, no. 3, pp. 524–553, 2015. https://doi.org/10.1111/deci.12205
[6] J. Kahl, S. De Klerk, and R. Ogulin, "Agile strategies for middle managers," *Management Decision*, vol. 60, no. 1, pp. 146–166, 2022. https://doi.org/10.1108/MD-07-2020-0889
[7] G. Matharu, A. Mishra, H. Singh, and P. Upadhyay, "Empirical study of agile software development methodologies," *ACM SIGSOFT Software Engineering Notes*, vol. 40, no. 1, pp. 1–6, 2015. https://doi.org/10.1145/2693208.2693233
[8] R. Setiawati *et al.*, "The role of information technology in business agility: Systematic literature review," *Quality - Access to Success*, vol. 23, no. 189, pp. 144–149, 2022. https://doi.org/10.47750/QAS/23.189.16
[9] K. Singh, "Agile methodology for product development: A conceptual study," *International Journal of Recent Technology and Engineering (IJRTE)*, vol. 10, no. 1, pp. 209–221, 2021. https://doi.org/10.35940/ijrte.A5899.0510121
[10] E. P. Wonohardjo, R. F. Sunaryo, and Y. Sudiyono, "A systematic review of scrum in software development," *JOIV: International Journal on Informatics Visualization*, vol. 3, no. 2, pp. 108–112, 2019. https://joiv.org/index.php/joiv/article/view/167
[11] W. Sun and C. Schmidt, "Practitioners' agile-methodology use and job perceptions," *IEEE Software*, vol. 35, no. 2, pp. 52–61, 2018. https://doi.org/10.1109/MS.2018.1661333
[12] V. Lalsing, S. Kishnah, and S. Pudaruth, "People factors in agile software development and project management," *International Journal of Software Engineering & Applications (IJSEA)*, vol. 3, no. 1, pp. 117–137, 2012. https://doi.org/10.5121/ijsea.2012.3109
[13] M. Kropp, A. Meier, C. Anslow, and R. Biddle, "Satisfaction, practices, and influences in agile software development," in *EASE '18: Proceedings of the 22nd International Conference on Evaluation and Assessment in Software Engineering*, 2018, pp. 112–121. https://doi.org/10.1145/3210459.3210470
[14] K. Conboy, S. Coyle, X. Wang, and M. Pikkarainen, "People over process: Key challenges in agile development," *IEEE Software*, vol. 28, no. 4, pp. 48–57, 2011. https://doi.org/10.1109/MS.2010.132
[15] D. J. Fernandez and J. D. Fernandez, "Agile project management—agilism versus traditional approaches," *Journal of Computer Information Systems*, vol. 49, no. 2, pp. 10–17, 2008. https://www.tandfonline.com/doi/abs/10.1080/08874417.2009.11646044
[16] T. W. Ng, L. T. Eby, K. L. Sorensen, and D. C. Feldman, "Predictors of objective and subjective career success: A meta-analysis," *Personnel Psychology*, vol. 58, no. 2, pp. 367–408, 2005. https://doi.org/10.1111/j.1744-6570.2005.00515.x
[17] Q. Chen, J. A. Wang, R. Ou, J. Sun, and L. C. Chang, "Disruptive technologies and career transition strategies of middle-skilled workers," *Career Development International*, vol. 24, no. 5, pp. 475–490, 2019. https://doi.org/10.1108/CDI-06-2018-0172
[18] D. Papathanasiou, K. Demertzis, and N. Tziritas, "Machine failure prediction using survival analysis," *Future Internet*, vol. 15, no. 5, p. 153, 2023. https://doi.org/10.3390/fi15050153
[19] K. Durczak, J. Selech, A. Ekielski, T. Żelaziński, M. Waleński, and K. Witaszek, "Using the Kaplan–Meier estimator to assess the reliability of agricultural machinery," *Agronomy*, vol. 12, no. 6, p. 1364, 2022. https://doi.org/10.3390/agronomy12061364
[20] E. L. Kaplan and P. Meier, "Nonparametric estimation from incomplete observations," *Journal of the American Statistical Association*, vol. 53, no. 282, pp. 457–481, 1958. https://doi.org/10.2307/2281868

[21] V. S. Deo, V. Deo, and V. Sundaram, "Survival analysis-part 2: Cox proportional hazards model," *Indian Journal of Thoracic and Cardiovascular Surgery*, vol. 37, pp. 229–233, 2021. https://doi.org/10.1007/s12055-020-01108-7

[22] Z. Zhang, "Parametric regression model for survival data: Weibull regression model as an example," *Ann. Transl. Med.*, vol. 4, no. 24, pp. 1–6, 2016. https://doi.org/10.21037/atm.2016.08.45

[23] J. F. Tripp, C. K. Riemenschneider, and J. B. Thatcher, "Job satisfaction in agile development teams: Agile development as work redesign," *Journal of the Association for Information Systems*, vol. 17, no. 4, pp. 267–307, 2016. https://doi.org/10.17705/1jais.00426

[24] E. L. C. Law and M. K. Lárusdóttir, "Whose experience do we care about? Analysis of the fitness of Scrum and Kanban to user experience," *International Journal of Human-Computer Interaction*, vol. 31, no. 9, pp. 584–602, 2015. https://doi.org/10.1080/10447318.2015.1065693

[25] J. Allen and A. De Grip, "Does skill obsolescence increase the risk of employment loss?" *Applied Economics*, vol. 44, no. 25, pp. 3237–3245, 2012. https://doi.org/10.1080/00036846.2011.570727

[26] R. J. Faberman, A. I. Mueller, A. Şahin, and G. Topa, "Job search behavior among the employed and non-employed," *Econometrica Journal of the Econometric Society*, vol. 90, no. 4, pp. 1743–1779, 2022. https://doi.org/10.3982/ECTA18582

[27] M. D. Kadenic, K. Koumaditis, and L. Junker-Jensen, "Mastering scrum with a focus on team maturity and key components of scrum," *Information and Software Technology*, vol. 153, p. 107079, 2023. https://doi.org/10.1016/j.infsof.2022.107079

[28] A. Montenegro, "Competences for the future: A comparative analysis of agile certification," *European Project Management Journal*, vol. 9, no. 2, pp. 46–54, 2019. https://doi.org/10.18485/epmj.2019.9.2.5

[29] A. Hidayati *et al.*, "Scrum team competencies in information technology professionals in the global software development environment," *International Journal of Human Capital and Information Technology Professionals (IJHCITP)*, vol. 13, no. 1, pp. 1–21, 2022. https://doi.org/10.4018/IJHCITP.293233

[30] J. Mehta *et al.*, "Becoming an Agile change conductor," *Frontiers in Public Health*, vol. 10, 2022. https://doi.org/10.3389/fpubh.2022.1044702

[31] E. Gunawan, Y. Mulyadi, and I. Kustiawan, "Gender inequalities in STEM careers in developed and developing countries: A systematic review," in *Proceedings of the 4th International Conference on Innovation in Engineering and Vocational Education (ICIEVE 2021)*, in Advances in Social Science, Education and Humanities Research, 2022, pp. 57–61. https://doi.org/10.2991/assehr.k.220305.012

[32] I. L. Beraza, J. M. Vara, D. Granada, C. Gómez, and F. J. Pérez-Blanco, "On the impact of project management certification for software projects and practitioners," *IEEE Software*, vol. 40, no. 5, pp. 100–107, 2023. https://doi.org/10.1109/MS.2023.3286118

6 APPENDIX

6.1 Dataset structure

In this section, is detailed the complete set of data retrieved from the poll taken to Engineers who contributed to this study.

Table A1. Poll structure, questions, and data details

Cod	Associated Variable	Associated Question	Characteristics of Answer
P01	NAME	Name	Free Text
P02	AGE	Age	Integer
P03	SEX	Sex	Male/Female
P04	CLASIFF	Profession Background	BA: Business Administration, CS: Computer Science, EE: Electrical Engineering, OT: Other
P05	COUNTRY	Country	Options: Chile, Argentina, Peru, Bolivia, Uruguay, Paraguay, Ecuador, Venezuela, Colombia, Brazil, Mexico, Spain
P06	GRAD	Do you have Graduate/Postgraduate studies?	YES = 1; NO = 0
P07	UNDERG	Where did you complete your Undergraduate Studies? (Institution)	Free Text
P08	T0	When did you get your first certification?	Date
P09	X_PROM	Have you ever been promoted thanks to your obtained certification(s)?	YES = 1; NO = 0
P10	T_PROM	In case of being affirmative your previous answer. When did it happen?	Date, if P09 = NO, then date of end of the study
P11	X_NJOB	Have you ever got a new job thanks to your obtained certification(s)?	YES = 1; NO = 0
P12	T_NJOB	In case of being affirmative your previous answer. When did it happen?	Date, if P11 = NO, then date of end of the study
P13	X_SHIFT	Have your job description been adjusted to be more aligned to your obtained certification(s)?	YES = 1; NO = 0
P14	T_SHIFT	In case of being affirmative your previous answer. When did it happen?	Date, if P13 = NO, then date of end of the study
P15	C01_SCRUMMASTER	Did you get Scrum Master certification?	YES = 1; NO = 0
P16	C02_SCRUMLEVEL	Did you get Scrum Level certification?	YES = 1; NO = 0
P17	C03_PRODUCTOWNER	Did you get Product Owner certification?	YES = 1; NO = 0
P18	C04_DESIGNTHINKING	Did you get Design Thinking certification?	YES = 1; NO = 0
P19	C05_AGILETESTING	Did you get Agile Testing certification?	YES = 1; NO = 0
P20	C06_AGILEPROGRAMMING	Did you get Agile Programming certification?	YES = 1; NO = 0
P21	C07_AGILECYBERSEC	Did you get Agile Cybersecurity certification?	YES = 1; NO = 0
P22	C08_MANAGEMENT30	Did you get Management 3.0 certification?	YES = 1; NO = 0
P23	C09_LEANMANAGEMENT	Did you get Lean Management certification?	YES = 1; NO = 0
P24	C10_KANBAN ESSENTIALS	Did you get Kanban Essentials certification?	YES = 1; NO = 0
P25	C11_LEANPORTFOLIOMGT	Did you get Lean Portfolio Management certification?	YES = 1; NO = 0
P26	C12_OKRLEADERSHIP	Did you get OKR Leadership certification?	YES = 1; NO = 0
P27	C13_AGILEAUDIT	Did you get Agile Audit certification?	YES = 1; NO = 0
P28	C14_JIRAFORAGILETEAMS	Did you get Jira for Agile Teams certification?	YES = 1; NO = 0
P29	C15_OTHER	Did you get other certification?	YES = 1; NO = 0

6.2 SPSS script

In this section is shown the used syntax to run Kaplan-Meier model for each labor effect.

```
KM D_PROM
 /STATUS=X_PROM(1)
 /PRINT TABLE MEAN
 /PLOT SURVIVAL OMS HAZARD.

KM D_NJOB
 /STATUS=X_NJOB(1)
 /PRINT TABLE MEAN
 /PLOT SURVIVAL OMS HAZARD.

KM D_SHIFT
 /STATUS=X_SHIFT(1)
 /PRINT TABLE MEAN
 /PLOT SURVIVAL OMS HAZARD.

KM D_EFFECT
 /STATUS=EFFECT(1)
 /PRINT TABLE MEAN
 /PLOT SURVIVAL OMS HAZARD.
```

7 AUTHORS

Rodrigo A. Crisostomo is with the Facultad de Ingeniería y Empresa, Universidad Católica Silva Henriquez, Santiago, Chile (E-mail: rcrisostomoz@ucsh.cl).

Nicolas A. Nunez is with the CENTRUM Católica Graduate Business School, Lima, Peru; Pontificia Universidad Católica del Perú, Lima, Peru (E-mail: nnunezm@pucp.edu.pe).

Giuliano Lopez-Burga is with the San Ignacio de Loyola – Escuela Isil, Lima, Peru (E-mail: glopez@isil.pe).