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Lean Thinking in civil construction with the help of methods from psychology

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ABSTRACT
Since civil construction is a field that needs human labor on a daily basis, Lean Thinking seeks a better production, with fewer errors and waste of value. For the implementation of the system, it is necessary to apply other methods, coming from psychology and capable of studying the different types of personalities, which are the Enneagram and NEO-FFI, being linked to each other. In order to verify the variation in the production of the activities in which the tools are applied, a study was carried out in the form of a questionnaire about a management system capable of increasing production and improving quality in civil construction, through the identification of the profiles of people with the greatest deficit in the identified services. The study was carried out in two works in the city of Goiânia, and it was possible to carry out a training based on the treatment mode of each profile and thus analyze the results obtained about it, the activities that were part of the study, presented a better production, progressing by 38.78% and 19.57% in works 1 and 2 respectively, thus generating savings and proving efficiency of the methods adopted.

Keywords: Lean Thinking, NEO-FFI, Production, Training, Cost.

1 INTRODUCTION

Considering that civil construction is one of the areas that moves and generates the most jobs in the country, it is essential to look for alternatives that reduce its high cost.

In order to reduce waste, increasing production and consequently reducing its execution time and cost, a method dating back to the 90s, known as Lean Thinking was employed. According to Motta (2000), the implementation of the system in civil construction presents some difficulty, as it deals with people of different ideologies.

For this, together with Lean, other means can be adopted, seeking excellence in its application, such as the Enneagram, which helps in the identification of personalities, this added to the NEO-FII, also known as the model of the five major factors, makes it possible to analyze how the five existing personality aspects influence the individual, which interconnected the three capacities determine the strengths in relation to each type.

Such tools collaborate with interpersonal relationships, being able to bring improvements in production and quality in the inserted environment, including civil construction.

Therefore, the present work aims to analyze the variation in the production of the activities in which the studied methods were applied, eliminating waste, and thus, consequently, from the savings that can be measured, enable the calculation of the cost of the time spent for the project to be employed, in addition to providing the verification of the veracity of the work of Cruz and Sobrinho (2018).

2 THEORETICAL FOUNDATION

2.1 LEAN THINKING

The concept of lean thinking, first introduced by Womack, Jones and Ross (1998), was developed in the 90s, based on the Toyota Production system, created by the Japanese Taiichi Ohni. Toyota, seeking to insert and maintain itself in the Japanese market, saw the need to implement a production flow, with highly flexible technologies, error-proof processes and organization by product family to ensure variety in production.

A new model of manufacturing production is founded, with a focus on eliminating waste through lean thinking in companies. The lean mindset is established on five principles: Value; Value Stream; Flow; Pull Production; Perfection. (FONTANINI, 2004).

According to Fontanini (2004), techniques related to lean thinking were generated with the intention of eliminating waste, such as Just in Time.

Maia, Alves and Leão (2011) clarify that the principles make it possible to reduce or even eliminate the seven types of waste identified, namely: excess production, movement, transportation, inventory, waiting, unnecessary activities and defects.

The five principles were conceptualized by Womack, Jones and Ross (1998), as follows:

Value – dictated by the customer, it is how much they are willing to pay for the product offered, they want the product to be delivered immediately and meet their expectations. Lean thinking encourages executors to rethink value, starting to see it from the customer's point of view. For this, it is necessary to have a production with quality products and staff.

Value Stream – a lot of waste happens because there is no rigorous inspection of the production stages, thus not having a critical analysis of its real need. The value stream, or value chain, is a set of behaviors, making the product go through three critical analyses, problem solving task, information management and physical transformation.

Flow – production steps must flow continuously, making the storage of batches in departments a waste.

Pull Production – allows the customer to order the product, avoiding inventories. Lean production makes it possible for the product to be made under any immediate change, since there are no inventories.

Perfection – the principles are interconnected, when the previous four are applied, the time spent is reduced, as well as the number of errors, also reducing waste.

Inserting lean thinking in civil construction makes the activities be carried out in an integrated way, with a harmonious process, that is, at the same pace, according to Rosenblum et al. (2007), the method allows to break the isolation of the stages of activities of the work.

Rosenblum (2007) also says that in order to plan with lean thinking, it is based on the same assumption as conventional planning, which is the identification of activities. Subsequently, the number of times the activity is repeated, the time interval taken for the repetitions to be executed, is determined, which enables specific work fronts for the activity processes. Making possible a flowchart of the activities of the work, essential to reduce waits and rework on the site.

According to Souza et. Al (2005), in a study carried out, could notice that the modifications requested by customers hinder the stability of the process flow within the construction site, the lack of detailed projects with the modifications generates doubts at the time of execution, added to the rework due to the changes. All of this leads to a waste of time and material.

In a case study, Mota and Alves (2008) found that in a production line of 18 identical houses there was a 30% reduction in the time spent to build using the lean method compared to the conventional system.

Ensuring the execution of a work in a shorter time, requires, in addition to saving time with the rescheduling of activities through the flowchart, to encourage workers to produce more than what they are used to, for this the incentive system is used, rewarding workers who could yield more and in less time than planned. Mota and Alves (2008), in a case study, also reported that during each half-day saved, the worker received a coupon to participate in a raffle with different prizes at the end of the project. The hardest working teams were rewarded with more chances to win the prizes.

In addition to the incentives, it was seen the need to create a purchasing system, aiming to eliminate work stoppages, through the MS Excel software, a spreadsheet was set up that indicated the materials needed to perform a certain task, as the orders were not placed, the cells changed color showing the occurrence of delay, in order to alert about the need for purchase. (MOTA and ALVES, 2008).

According to Dantas (2006), the unit ratio of production (RUP) is a productivity indicator that allows the analysis of the production of labor, the OR is obtained through the man-hour ratio (input data) to the quantity of service performed (output data), the higher its value, the worse the productivity, that is, a longer period of time is needed to produce a unit.

Barzellay and Longo (2011), the national system of research on costs and indices of civil construction (SINAPI), has a national scope, is constantly updated, providing information on costs and indices related to inputs and compositions of civil construction. The collection is carried out monthly

and nationally by the IBGE, in order to compose the database of inputs of the system with materials, labor and equipment. It serves as a reference for budgeting and production comparisons.

As a means of avoiding unnecessary waits due to doubts or errors, Souza et. al (2005) found that the installation of a system named Andon facilitates communication between workers and administrative staff. It works as follows: a switch with three buttons is installed on all floors, the three sections differentiated by colors indicate normality, possible interruptions due to problems, as well as stoppage. As soon as the team starts a task on a certain floor, the normality key must be pressed, and remain until the work is finished or one of the other two keys is needed. With a monitor installed in the management of the work, the person in charge receives the information making it possible to act immediately in case of identification of abnormalities.

Fontanini (2004) presents some strategies with the implementation of lean thinking, which can promote improvements in the field of civil construction, namely: minimization of lot sizes; partnership with suppliers; Reduction of rework in the elaboration of products and improvement in the selection of suppliers.

Pinto (2008) says that the greatest source of waste is the failure to take advantage of each person's capacity and potential. Lean thinking should not be judged as a means to radical implementations in the organization of the system, but rather as a change in corporate culture and attitudes. Therefore, most of the time it is used by top management, which has the authority to implement changes in the company as a whole. The objectives of Lean Thinking are: flexibility and quality of the process, thus reinforcing its ability to compete in an increasingly globalized and demanding world. In short: it is an updated Toyota Production System with the insertion of new practices and tools.

Motta (2000) points out that, because they are a threat to the comfort zone and to practically everything that is familiar, the changes can generate resistance on the part of the employees, but as the prospects for improvement become greater, acceptances begin to appear. Hernandez and Caldas (2001) state that behaviors in the face of any process of change can range from acceptance and indifference to resistance. Resistance, being one of the barriers that appear opposing the process of change, has led to the development of numerous strategies to overcome it, not always successfully, requiring a better understanding of its causes and consequences.

2.2 ENNEAGRAM

In a society there are different types of people and personalities, which characterizes each one as unique. According to Maschio (2016), the Enneagram has an oriental origin, from ancient religions and mysticism, whose knowledge about personal predispositions and self-knowledge was transmitted orally.

According to Palmer (1993), the shape of the enneagram known today, in which it is understood in psychological terms, was possible thanks to the Chilean Naranjo, together with the Bolivian Oscar Ichazo, responsible for the improvement of the technique.

The word Enneagram comes from the Greek Ennea, which according to Melendo (2001), means nine and Gramma, which means points, thus being a figure of nine points. It is currently being used in order to point out personal characteristics, classify them into distinct groups, identifying appropriate profiles for certain tasks. Thus, each person fits within a personality pattern, and this pattern shows how each personality type reacts when relating to other people.

According to Rodrigues (2004), the growth of the tool's applications in the business world has been significant, and it is already present in renowned companies, such as IBM, Sony, Boeing, Disney, among others. The advancement with studies on the enneagram favors alternatives to solve problems arising from the professional environment, through individual and group understanding and development, in addition to self-knowledge as well as personality, promoting actions to overcome weaknesses, as well as actions aimed at intensifying and stimulating the growth of professionals.

For Damião (2008), identifying the enneagram profiles, as well as the attitudes and behaviors that govern them, is knowing the competencies and abilities of the being, that is, their strengths and the points of improvement that are waiting for development.

Ribeiro (2008) states that the deepening of studies on the enneagram enables personal recognition, exercising the perception of the automatic pattern of the individual in action, making him capable of increasing his degree of autonomy under a given act.

Schultz (2010) divides the study of human behavior into 9 personality types, with their radars, where the radar represents the attention focused on the preferred characteristic of each personality. These are:

Perfectionist (radar: duty);
Helpful (radar: need of others);
Successful (radar: success);
Romantic (radar: lack);
Observer (radar: information);
Questioner (radar: medo);
Dreamer (radar: pleasure);
Confronting (radar: power);
Conciliatory (radar: tranquility).

Perfectionist: This is the type who cares about everything around him always being in the most perfect way. They are always striving for excellence in everything they do, they tend to be critical, controlling, and impatient.

Helpful: They feel the need to help others. They are willful and strategic, they have the need to show themselves and they feel loved only when they are useful.

Successful: seeks to derive value through their creations, ideas, projects, and achievements. He's a very vain guy, so he's always advertising himself and he's very competitive. If someone owns something close to him, he always thinks he can own it too, and in a better way.

Romantic: one of the personalities that suffers the most, because it is guided by feelings and sensations, leaving attention focused on what is lacking. He is able to guide and advise.

Observer: Is always looking for information. They tend to minimize contact because they have a habit of seeking self-protection. They are rarely interested in riches or material things, they believe that one should always think before acting.

Questioner: is always in search of security through values such as morals and ethics. Has difficulty finishing tasks that have not been checked by someone else.

Dreamer: has the need to be involved in various activities to produce well. He is not adept at routine and increases his production when it is for new projects.

Confrontational: studies to put something into practice, very strategic when the goal is to move forward. It is easy to understand power, that is, who is in charge and who is in charge. He works until he achieves all his goals, he likes to break taboos and achieve impossible goals.

Conciliatory: tends to be calm, adapts to the situation and tries not to confront. He is a pacifist, he can listen and agree with any point of view. He cares more about his neighbor than himself, he is afraid of his position being disregarded, he has learned to embody the enthusiasm of others.

Cursino (2011) describes the enneagram as a tool for personal, professional, and organizational development, where nine types of personalities are contained, along with their probable characteristic behaviors, but the resources of the enneagram go beyond the possibility of identifying personalities, it enables to describe what stimulates the individual to make decisions, whether good or bad, thus being able to trace effective paths for self-development.

In order to have good management in a company, it is important that the supervisor is able to know himself, thus ensuring a better conduct with those who make up his team, how to manage them individually and in groups, enabling the proper framing of each employee in a line of service. Self-knowledge is possible through the help of the enneagram. (LIMA and CARVALHO, 2017).

Through the work developed by Cruz and Sobrinho (2018) it was possible to identify for each enneagram personality type a form of treatment, most of them linked to the valorization of the individual and his ideas. For the perfectionist type, it was identified that they like to have the activities well clarified and do not have good acceptance with negative feedback, for the helpful it is necessary to praise the service performed. The successful one requires clarity and objectivity when assigning him a task, while the romantic one should have the emotional well valued and should not be interrupted.

The observer type needs his space to be respected and likes work that makes him think, the questioner should be treated in a logical and direct way and should not be confronted. Considering the dreamer, it is necessary to be relaxed and avoid criticism of his ideas exposed. Regarding the confrontationist, it is necessary to be direct and assertive, criticizing this type influences professional growth, and for the conciliator, it is necessary to value and include him in the activities, in addition to making him feel important in the work environment.

2.3 NEO-FFI

The five-factor model, known as NEO-PI-R, brings many advantages through its analysis of personality, enabling an explanation of the multiple traits identified by psychology. (BERTOQUINI and RIBEIRO, 2006).

According to Bertoquini and Ribeiro (2006), due to the extension of the NEO-PI-R, which contains 240 questions, making it tiresome, there was a need to create compact versions, such as the NEO-FFI (NEO-Five Factor Inventory), which has 60 questions, but without losing its benefits. As in the original version, the reduced questionnaire is answered on an identification scale ranging from 0 to 4 points, identified as full disagreement to full agreement. In general, the time offered to answer the questionnaire is 15 minutes, and the five factors evaluated are: Conscientiousness (C); Neuroticism (N); Extraversion (E); Kindness (A) and Openness to Experience (O).

Also according to Bertoquini and Ribeiro (2006), the tool has been used to explore the relationships between the five dimensions of personality with learning, success or failure, as well as with interpersonal problems. In it, it was possible to analyze that the level of education, age, together with some personal characteristics, influence the five personality factors, so that those who remain in schools for less time tend to have reduced scores in the item Openness to Experience. Kindness and Conscientiousness are linked with time, and increase as the latter goes on, the opposite occurs with the others.

Passos and Laros (2014), and Faria (2014), describe some characteristics of the five major factors, and are as follows:

Neuroticism is related to the emotional, it measures the instability of the same, people with a predisposition to this personality trait are more likely to develop disorders such as depression and anxiety. On the questionnaire, low scores are ideal for neuroticism profiles, as these are optimistic, easy-going people.

Extroversion is linked to socialization, people with this characteristic have ease and ability in interpersonal relationships. High scores are sought, they indicate sociable people.

Openness to experience refers to the knowledge of the new, people willing to receive new knowledge tend to be more creative and liberal, they are open to new ideas. High scores in the questionnaire are sought, and it is interpreted that there is openness to the new.

Like extroversion, agreeableness is also linked to socialization, it measures the quality of it, reveals how pleasant and friendly the individual can be towards the other, as well as the opposite, it also reveals self-centered and withdrawn people. It is also ideal high scores, represents friendly people.

Conscientiousness is influenced by time, synonymous with personal or professional fulfillment, among others. In general, they are people who follow their goals to the letter, control their own instincts well, and are willing to meet the goals they propose. With a high score, it reveals committed people.

It is possible to correlate the NEO-FFI tool with the 9 personality types of the Enneagram, as seen by Bravo (2017) in his applications. For example, the helpful type is expected to have low levels in their trait of Neuroticism, Openness to Experience and Conscientiousness, and high values in Extraversion and Agreeableness. The perfectionist type, on the other hand, has a high score in Openness to Experience, and medium in relation to Neuroticism. (BRAVO, 2017).

These factors are related to the individual's abilities, which can be conceptualized as know-how, a physical or mental action that indicates the acquired capacity.

All types are shown in Table 1 with their respective NEO-FFI correspondents.

Table 1 – NEO-Enneagram Theory.

Personalidades	Neuroticismo	Extroversão	Abertura à Experiência	Amabilidade	Conscienciosidade
Perfeccionista	Médio	Baixo	Alto	Médio	Alto
Prestativo	Baixo	Alto	Baixo	Alto	Baixo
Bem-sucedido	Baixo	Alto	Alto	Alto	Alto
Romântico	Médio	Baixo	Baixo	Baixo	Baixo
Observador	Baixo	Alto	Baixo	Alto	Alto
Questionador	Médio	Alto	Alto	Alto	Baixo
Sonhador	Alto	Médio	Baixo	Médio	Alto
Confrontador	Médio	Baixo	Alto	Baixo	Alto
Conciliador	Baixo	Baixo	Médio	Alto	Médio

Source: Personality and Leadership Profile of the Middle Management Personnel of the Production Area of two Multinational Companies with Presence in the City of Cuenca. (Bravo 2017).

The classification levels are shown in Table 2 below:

Table 2 – Interval for classification of score levels.

	Neuroticismo	Extroversão	Abertura à Experiência	Amabilidade	Conscienciosidade
Baixo	0 a 10	0 a 28	0 a 24	0 a 29	0 a 32
Médio	11 a 17	29 a 35	25 a 37	30 a 34	33 a 43
Alto	18 a 48	36 a 48	37 a 48	35 a 40	39 a 48

Source: Personality and Leadership Profile of the Middle Management Personnel of the Production Area of two Multinational Companies with Presence in the City of Cuenca. (Bravo 2017).

Bravo (2017), points out that the study of personalities with the help of NEO-FFI, added to the particularities of the enneagram, are useful for identifying the profiles of a company's collaborating team, making it possible to generate action plans that aim at improvements and consequently development, suggests that knowledge about the two theories be used as support when hiring new employees, ensuring the choice of profiles that suit the positions offered.

2.4 THE THREE CAPACITIES OF THE INDIVIDUAL

Antunes (1999) considers that man has three capacities that can be called motor or instinctive, emotional and mental or intellectual. The skills that man can develop are intimately linked to his capacities.

Goleman (2001) cites an interdependence between reason and emotion, he says that man is possessed of two minds; the rational and the emotional and they usually work in balance.

Bechara, Daniel and Damasio (2000) warn that emotions unconsciously affect decision-making. This shows that man uses his capacities in an unbalanced way, caused by the lack of knowledge of himself and by prioritizing activities that use one capacity more than another.

Macarenco, Damião and Arnosti (2004) state that motor capacity is responsible for the individual's action. The emotional one benefits the feeling and the cognitive one is responsible for the ability to think or reason. The authors use Table 3 to show how these capacities may relate to the nine personality types of the Enneagram.

Table 3 – Origin of the nine styles of the Enneagram.

Estilo	Classificação	Capacidade Preferida	Capacidade de apoio	Capacidade reprimida
1	Perfeccionista	Motora	Emocional	Cognitiva
2	Prestativo	Emocional	Motora	Cognitiva
3	Bem-sucedido	Emocional	Motora ou Cognitiva	Emocional
4	Romântico	Emocional	Cognitiva	Motora
5	Observador	Cognitiva	Emocional	Motora
6	Questionador	Cognitiva	Emocional ou Motora	Cognitiva
7	Sonhador	Cognitiva	Motora	Emocional
8	Confrontador	Motora	Cognitiva	Emocional
9	Conciliador	Motora	Emocional ou Cognitiva	Motora

Source: Macarenco, Damião and Arnosti, 2004.

Batista (2008) states that there are several studies on intelligences, some consider it an innate ability, which is born with man, while others treat it as an activity developed that is improved through learning.

3 METHODOLOGY

The methodology of this work was through bibliographic surveys on Lean Thinking, Enneagram, NEO FFI and the three capacities of the individual made through books, articles and digital library. The case study covers two works of different construction companies in the city of Goiânia. Work 1 consists of 32 standard floors with a total of 128 apartments of 105 and 102 m², and Work 2 consists of 23 standard floors and 149 apartments ranging from 45 m² to 137 m², both correspond to a medium standard and are in the phase of fine work, not being considered any type of customization.

To obtain data, the NEO-FFI questionnaire (Appendix A) was applied to those responsible for performing activities identified as problematic by the weekly planning, whether it was the deficiency in production or quality, always using fictitious names to identify those in charge of the analyzed activities, both volunteered to help without knowing about the monitoring.

Once the personalities of the individuals were identified through the score found in the questionnaire for the five factors added to the relationship they have with the Enneagram, the follow-up was done in order to generate an increase in production and quality standards, based on the Lean Thinking Value Stream analysis. The measured production took place in identical units and initially had as reference the value of the SINAPI 2019 table of inputs, then the labor cost of the individuals

who were part of the study was calculated. The value found multiplied by the number of teams enabled the total cost that the activity would have with all the trained employees. The measurements took place between August and October.

Based on the minimum salary of an engineer, the cost for the application of the questionnaire and follow-up was calculated, as well as how much this value represents in terms of attainable labor savings. Although Work 2 presented itself with the status of fine work, some of the employees still present were responsible for the rough work activities, such as masonry, these also passed the NEO-FFI test questions to verify the veracity of Cruz and Sobrinho's work of the year 2018, since the article in question referred to a work in the rough work stage.

4 RESULTS AND DISCUSSION

It was verified through the weekly planning that the plastering activity in Work 1 presented deficits in terms of quality, and it was necessary to return to the apartments, to correct the service, which affected the production. After having performed the NEO-FFI test with the person responsible for executing the unit in which the highest number of errors was found, this one coming from another activity, it was possible to verify that the bricklayer fit into the Dreamer type, in which according to Cruz and Sobrinho (2018) in the Enneagram this type of profile has the characteristics of not being adept at routines, Liking creative possibilities, and thus producing new ideas, is also impulsive, and reactive to criticism. They also indicate that the proper way to deal with the dreamer profile is to avoid criticism when he tries to put new ideas into practice, value him as a person, making the most of his disposition, supervise him.

In view of his weaknesses and strengths, in order to improve the quality of the plastering activity, the treatment was made based on the dreamer profile, which initially consisted of listening to what the mason had to say about the service performed by him, and also of past experiences, in order to develop strategies that would help him, With that, a creative side was discovered in him, who likes to experiment with new ideas, which was already expected, due to his profile. Having the necessary confidence on the part of the mason, he confessed that in the previous units he used inadequate material to resquare and batten, in addition to a difficulty in applying the mortar with the trowel, changing his materials and inserting the planer as a new tool to apply mortar to the masonry, the result was soon obtained, between the units before and after the training, As these were the only ones performed by him, the number of errors related to plumb, square, resquares and finishing, fell by about 83.33%, as can be seen in Table 4 below:

Table 4 – Quality of the internal plaster in Site 1.

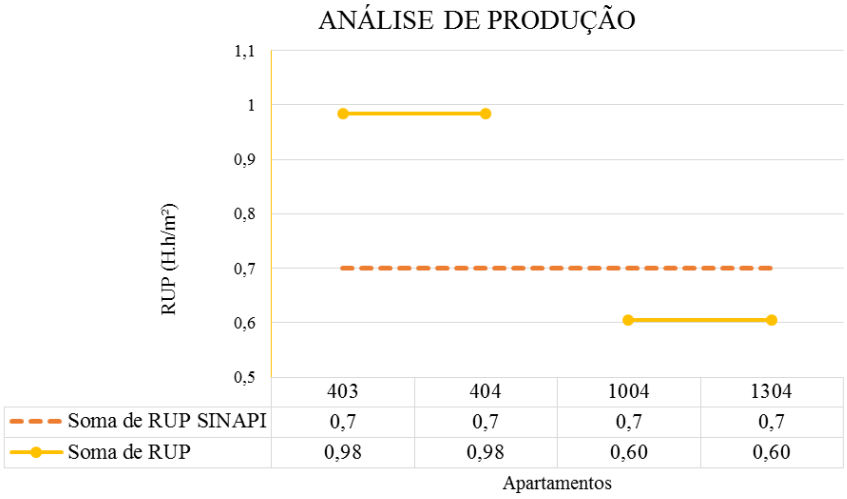
REBOCO INTERNO					
Pav	Apto	Profissão	Treinamento	Nº de erros	Redução de erros após treinamento (%)
12	1203	Pedreiro	Não	5	-
17	1703	Pedreiro	Não	6	-
23	2303	Pedreiro	Sim	2	66,67
31	3103	Pedreiro	Sim	1	83,33

Source: The authors.

The quantification of the errors was made through the service inspection forms (Appendix B), and the percentages of reduction of the same on top of the apartment unit with the highest number of inadequacies.

Also in Work 1, it was noted that the activity of ceramic wall covering was slow in relation to the planning, based on this information, the questionnaire was applied to the responsible tiles, 1 of them with the dreamy profile seen above, and the other 2 with the conciliatory profile. Conciliators, they are ideal in activities that require a better intellectual performance, such as the case of laying cerâmico.Com the work diary the time spent in each apartment was obtained, and, therefore, for analysis, the tile maker whose profile was conciliatory and presented the highest unit ratio of production (RUP) was chosen, which measures the time in hours spent to be made 1 unit, in this case 1m², as shown in Graph 1:

Graph 1 – Comparison between the ORs in Work 1.



Source: The authors.

Seeking to improve productivity, the strategy described by Cruz and Sobrinho (2018) was used to treat this type of profile, such as praising them for the quality of the service presented, making them understand that they occupy an important place and stand out in the work environment, and always encouraging them to share any doubts, suggestions or problems they encounter during the activity, and

thus involving him in the participation of the activity not only as a manpower, but as a stakeholder. The initiative was successful, as indicated in Graph 1, the Man-hour ratio per m² reduced from 0.98 to 0.60, being below the value found in the SINAPI table, which means an increase in production of 38.78%, and about 14.29% in relation to SINAPI.

With the improvement in production, it was possible to measure the amount saved by the work, since the tile maker in question was paid per diem, and the team responsible for the coating activity totals 8 employees, leaving 16 units for each. Having a production of 0.98 h/m² in an 8-hour workday, 8.16 m²/day was produced, with the production of 0.60 H.h/m² and the same workday, 13.33 m²/day is produced, through Equation 1:

$$RUP = \frac{H.h}{m^2} \qquad (1)$$

This leads to a reduction of 30 days considering the 16 units executed with the new RUP, therefore, generates a cost saving of R$ 4,500.00 per tile maker, as shown in Table 5, having all 8 tile makers producing with the new RUP, the savings in labor would reach about R$ 36,000.00, a value that together with the days saved express significance in relation to the budget and deadline of a work.

Table 5 – Cost savings Construction 1.

RUP	M²	Dias	R$ diário	R$ total	Economia
0,98	635,2	78,00	R$ 150,00	R$ 11.700,00	R$ 4.500,00
0,6	635,2	48,00	R$ 150,00	R$ 7.200,00	

Source: The authors.

Table 6 is composed of all productions measured before and after the trainings of Work 2.

Table 6 – Measurement of activities in Site 2.

mês	profissão	treinamento	Produção (m²)	Dias trabalhados	SINAPI	RUP
setembro	azulejista	não	385,84	20	0,7	0,46
outubro	azulejista	sim	469,84	20	0,7	0,37
setembro	azulejista	não	358,69	20	0,7	0,49
outubro	azulejista	sim	425,38	20	0,7	0,42
setembro	pedreiro	não	775,68	23	0,47	0,27
outubro	pedreiro	sim	856,88	20	0,47	0,21

Source: The authors.

For the Tile Artist José da Obra 2, a dreamer-type profile was also found in the execution of the coating service. Although he showed little openness with the beginning of the training, after listening to his opinion about the work performed, it was possible to win over the mason in question. He did not

consider himself capable of increasing his production, however, valuing his ability, making him feel important, and after listening to his ideas about the work, he changed his way of thinking. Thus, to speed up the service, the access to materials was also improved, leaving them strategically arranged, and then the production in m² was measured and the new production was calculated, as shown in Table 6.

Therefore, associated with the month of September, the man-hour ratio decreased from 0.46 H.h/m² to 0.37 H.h/m² in the following month, considering the SINAPI Table, the tile maker in question was already considered productive, but an increase of 19.56% in production was noted.

In another case, a romantic profile was identified. Type 4 people can be considered creative and intense, but they have difficulties to work in a team, their preferred ability is the emotional one as shown by Damião (2010), therefore, the training is based on valuing the emotional and seeking services that can be performed alone.

For the tile artist João, who fits this personality, methods were used so that he could spend most of his time alone, such as sharing the helper with another colleague, so that he spends less time interrupting him, but always leaving the materials prepared for the work in a way that facilitates access. In addition, the individual and his personal problems were valued, and there was a decrease in the man-hour ratio from 0.49 H.h/m² to 0.42 H.h/m², a value already below the SINAPI Table, but there was an increase of 14.28% in production from one month to the next, as can be seen in Table 6.

With the verification of the short-term planning of Work 2, there was a delay in the internal plastering. Thus, each of those responsible for the execution of this service was analyzed and it was possible to notice a lower production of some masons in relation to others. Thus, after the application of the NEO-FII questionnaire to Bricklayer Pedro, the Conciliator type was identified, this profile can be considered as very calm people, who like to expose their ideas and be valued, care more about the desires of others than their own. For this, according to Cruz and Sobrinho (2018), the best way to treat this type is to make them feel important, letting them expose their ideas.

Putting their capabilities in view, with the intention of increasing the production of the overdue mason, a training was carried out that was based on listening to ideas about the work being performed, encouraging him, and showing that the delay was causing problems for others. After gaining the trust, the mason confessed that the reframings were a problem for him and so other tools were sought to try to facilitate the service: such as the use of the scantillion. Thus, with daily follow-up and the insertion of methods that facilitated their service, an increase in production was observed from one month to the next, as shown in Table 6.

Then, associating the production of one month with the man-hour ratio, there was a decline from 0.27 H.h/m² to 0.21 H.h/m², showing an increase in production of 22.22% from September to October.

Since these productions were monitored daily through the individual supervision form (Appendix C) and their savings, as previously seen, were also calculated for Work 2, as shown in Table 7:

Table 7 – Cost savings of the internal plastering service Work 2.

RUP	M²	Dias	R$ Diário	R$ Total	Economia
0,27	4964,93	168	R$ 120,00	R$ 20.160,00	R$ 4.440,00
0,21	4964,93	131	R$ 120,00	R$ 15.720,00	

Source: The authors.

Since for a mason the savings generated was R$ 4,440.00 reais and that in Work 2 there are five masons in the execution of the internal plastering service, it would then generate a saving of R$ 22,200.00 reais for all workers in this area.

For the tilemakers, the same calculation was made and the values in Table 8 were found.

Table 8 – Cost savings of the coating service Work 2.

RUP	M²	Dias	R$ Diário	R$ Total	Economia
0,46	1627,78	94	R$ 150,00	R$ 14.100,00	R$ 2.700,00
0,37	1627,78	76	R$ 150,00	R$ 11.400,00	

Source: The authors.

According to Table 8, it was possible to observe that considering a tile artist from Work 2, a saving of R$ 2,700.00 reais was calculated, counting on three tile artists in the entire work, a saving of R$ 8,100.00 reais would be obtained.

In general, the application of the NEO-FFI questionnaire in the studied works resulted in varied profiles, but with similar ways of coping, as shown in Table 9 below:

Table 9 – Profiles found in Works 1 and 2 and treatment used.

	Profissão	Personalidade	Capacidade Preferida	Capacidade Reprimida	Capacidade de apoio	Tratamento
Gabriel	Azulejista	Sonhador	Cognitiva	Emocional	Motora	compreender o ritmo, ser valorizado
João	Pedreiro	Conciliador	Motora	Motora	Emocional/ Cognitiva	ser valorizado e escutado
José	Azulejista	Sonhador	Cognitiva	Emocional	Motora	compreender o ritmo, ser valorizado
Lucas	Azulejista	Conciliador	Motora	Motora	Emocional/ Cognitiva	ser valorizado e escutado
Pedro	Azulejista	Romântico	Emocional	Motora	Cognitiva	ser valorizado e escutado

Source: The authors.

In addition, the cost of the time spent for the application and monitoring of the NEO-FFI was calculated, and how much it represents in relation to the savings generated, based on the minimum

salary of the engineering profession and the data obtained with Works 1 and 2 in the coating activity. Table 10:

Table 10 – Cost to apply the NEO-FFI and maintain it.

	Obra 1	Obra 2
Salário Base Engenharia (R$/mês)	**R$ 8.982,00**	**R$ 8.982,00**
Hora do Engenheiro (R$/h)	R$ 37,43	R$ 37,43
Tempo dedicado para aplicação do NEO-FFI e monitoramento (h)	6,33	6,33
Custo pelo tempo gasto para a implementação dos métodos (R$)	R$ 237,03	R$ 237,03
Economia capaz de ser gerada pela equipe de azulejistas (R$)	R$ 36.000,00	R$ 8.100,00
Custo em cima da economia (%)	0,66%	2,93%

Source: The authors.

The value presented is only in relation to the coating service, considering all the trained tile artists and with improved production.

It took 40 minutes to apply each questionnaire and an average of 10 minutes a day to follow up over 2 weeks. In the calculation, in addition to the measurement period, it was estimated that the entire team spent 10 minutes per week in an interval of 6 months, the time necessary for the total execution of the activity.

5 CONCLUSIONS

The studied tools from psychology, when added together contribute positively to the inserted environment, with the NEO-FFI, it becomes possible to identify the five factors present in each human being and the influence of these on the personalities of the Enneagram, these in turn, added to the capacities of man, contribute to the understanding and improvement of the being, which finally, generates the good practice of Lean Thinking, eliminating unnecessary waste.

By employing the methods in the civil construction sector, where a large part of the workforce lacks schooling, remarkable results were obtained, activities presented with production or quality deficiencies achieved improvement during the study. Through the OR, it was possible to measure the progress, as shown in Table 11:

Table 11 – OR's before and after training.

RUP (H.h/m²)					
Atividade	Antes		Depois		Referência SINAPI
	Obra 1	Obra 2	Obra 1	Obra 2	-
Reboco	-	0,27	-	0,21	0,47
Revestimento	0,98	0,46	0,60	0,37	0,70

Source: The authors.

Therefore, the estimated percentage of evolution in Works 1 and 2 was approximately 38.78% and 19.57%, respectively, in the coating activity and for Work 2; 22.22% with the plastering service.

From the increase in production, labor cost gains begin to appear, which are of fundamental importance in an increasingly competitive market, where profit becomes the economy generated.

The methods adopted are capable of being applied by the management team of a work, from the intern to the engineer in charge, the cost of the time spent for the application of the NEO-FFI questionnaire and follow-up, considering the base salary of an engineer, represents 0.66% in the economy of Work 1, since it did not have monitoring and had a production below that referred to by SINAPI, On the other hand, Work 2, which had a good production and little monitoring, still enables savings of R$ 8,100.00, which corresponds to an application cost of 2.93%.

With the results obtained, it is inferred the effectiveness in the conjunction of the applied methods, the ways of dealing with the personality types found in works 1 and 2 were focused on the emotional of the individual as suggested by Cruz and Sobrinho (2018). The acceptance and consequent development by the individuals analyzed, drives the belief that with all the teams of the different functions present in a work, when well trained, they can produce more, generating cost and time savings, these feasible of measurement for comparisons, in addition to providing proximity between the management team and labor.

The case study by Cruz and Sobrinho (2018), an article used as a reference, took place on site in the rough stage, with activities in the structure and sealing phase, so the profiles found differed from those present in Works 1 and 2, which characterized fine work, that is, in the finishing phase, however, there were still three employees in Work 2 who performed the masonry service, in which, when applying the NEO-FFI questionnaire, despite the few samples, the test result was compatible with the personalities found by the cited authors, namely: helpful, and 2 conciliators. This is necessary to affirm the veracity of the work developed by them, with emphasis on the stage of work analyzed.

Finally, it is suggested as an alternative for future study the application of the tools used in all stages and activities that make up a work, to analyze the influence on the final budget and delivery time of the construction. It is also possible to be applied in a more dynamic way, with the entire team together, making the cost of application negligible.

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ANNEXES AND APPENDICES

The questions that make up the NEO-FFI questionnaire are presented below, which were used to identify the profile of the Enneagram of some employees, applied during the technical visits in 2 works in Goiânia, inspection form of Work 1 and individual monitoring form of work 2.

Appendix A: NEO-FFI QUESTIONNAIRE:

Employee Name: Age: Job Title:

TESTING NEO-FFI					
QUESTIONS	I agree with each other	Disagree	I don't know how to evaluate / Neither disagree nor agree	Agree	I totally agree
1-I'm a carefree person					
2-I like to have a lot of people around me					
3-I like to focus on a fantasy and explore all its possibilities, letting it grow and develop					
4-I try to be polite to everyone I meet					
5-I keep my things clean and in order					
6-Sometimes I felt resentment and bitterness					
7-I am prone to laugh easily					
8-I find it interesting to learn and cultivate new hobbies (pastimes)					
Sometimes I bully or flatter people into doing what I want					
10-I am good at organizing my time in a way that gets things done on time					
When I'm under a lot of stress, sometimes I feel like I won't be able to resist					
12-I prefer jobs that I can do alone, without being bothered by other people					
13-I am amazed at the variety of patterns I find in art and nature					
Some people think I'm jealous and selfish					
15-I often get into situations without being fully prepared for them					
16-I rarely feel lonely or sad					
17-I really like to talk to other people					
I believe that letting students listen to people with controversial ideas will only confuse and disorient them					
19-If someone starts a fight, I'm always ready to fight back					
20-I try to fulfill all my obligations responsibly					

21-I often feel tense and agitated					
22-I like to be in lively places					
23-Poetry touches me little or nothing					
I'm better than most people, and I'm aware of it					
25-I have clear goals and I seek to achieve them in an organized way					
26-Sometimes I feel like I'm worthless					
27-I don't like crowds and that's why I avoid them					
28-I have a hard time letting go of my imagination (daydreaming)					
29-When I am insulted, I try to forgive and forget					
30-I waste a lot of time before I focus on work					
- 31 I rarely feel scared(a) or anxious(a)					
32-I often feel myself bursting with energy					
Rarely do I realize the moods or feelings that different environments cause					
34-I tend to think the best about people					
35-I work hard to get what I want					
36- I often get annoyed with the way people treat me					
37-I am a cheerful and cheerful person					
I experience a wide variety of emotions and feelings					
Some people consider me cold and calculating					
40-When I make a commitment, people trust that I will fulfill it					
41-Often, when things go wrong, I get discouraged and feel like giving up					
42-I don't really like to talk to people					
Sometimes, when reading poetry or looking at a work of art, I feel a shiver, a surge of emotion					
44-I'm a stubborn big-headed person					

Sometimes I'm not as reliable as I should be					
46-I'm rarely sad or depressed					
47-My life is hectic					
I have little interest in speculating about the nature of the universe or the human condition					
49-Generally, I try to be attentive and delicate					
50-I am a productive person who always manages to get things done					
51-I often feel helpless, wishing that someone would solve my problems					
52-I am a very active person					
53-I have a lot of intellectual curiosity					
54-When I don't like someone, I make a point of showing it					
55-I never seem to be organized					
Sometimes I felt so embarrassed that I just wanted to disappear					
57-I'd rather mind my own business than be a leader for other people					
58-I often take pleasure in playing with abstract theories and ideas					
59-If necessary, I am willing to manipulate people to get what I want					
60-I strive to be excellent at everything I do					

Annex B: SERVICE INSPECTION SHEET:

Obra:

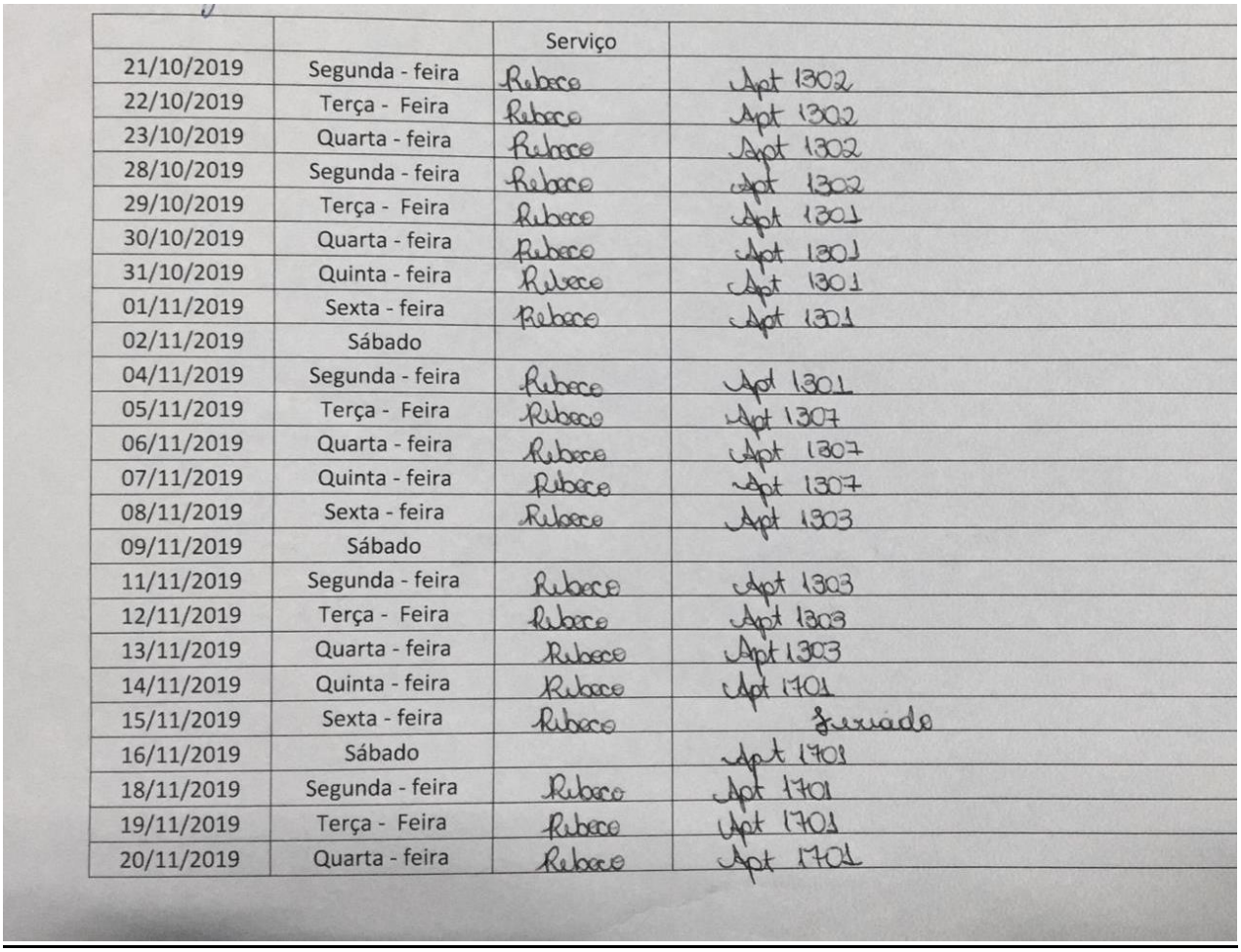
Data início: 10/07/19

FIS 09A	REBOCO INTERNO					O - Aprovado X - Reprovado ⊗ - Aprovado após reinspeção NA - Não aplicável						
Item de inspeção	Taliscas	Alvenarias	Contramarcos Chumbados	Instalações na alvenaria	Preparo da base	Medidas mínimas	Planicidade e prumo do reboco	Requadrações	Acabamento da superfície	Limpeza do Local	Localização	Responsável
Metodo de verificação	Antes do início do reboco, conferir através de Trena e regua a espessura da talisca, que deverá ter até 2 cm de espessura. Verificar o esquadro dos ambientes e espessura das paredes.	Verificar se toda as alvenarias estão concluídas e fixadas.	Checar se os contramarcos estão chumbados e com referencial de vãos definidos.	Averiguar se as instalações nas alvenarias estão concluídas.	Providenciar o preenchimento de furos provenientes de rasgos, depressões localizadas, quebra parcial de blocos, ninhos (bicheiras) de concretagem, fixação da tela de aço galvanizado com todo o preenchimento.	Observar as medidas mínimas: as bonecas mínimas para ambientes com revestimento cerâmico é de 7 cm e sem revestimento cerâmico é de 5 cm.	Verificar, por meio de uma régua de Nível e Prumo ou com uma Régua de alumínio acima de 1,8 m e Prumo de face.	Verificar, por meio de uma régua o alinhamento de viga e pilar e através de nível nivelamento da viga	Visual após a conclusão, verificar textura e emplacamento da argamassa.	Visual após o término dos serviços.		
Tolerância → / Data ↓	±3mm	-	-	-	-	-	±3mm	±2mm	-	-		
1 10/07	O	O	O	⊗	O	O	⊗	O	O	O	10° PAV	Gabriel
2 10/07	O	O	O	O	O	O	O	O	O	O	11° PAV	Gabriel
3 30/07	⊗	O	O	O	⊗	O	⊗	⊗	⊗	O	12 PAV	Gabriel
4 31/07	O	O	O	O	O	O	O	⊗	O	O	13° PAV	Gabriel
5 31/07	O	O	O	O	O	⊗	⊗	O	O	O	14° PAV	Gabriel
6 02/08	O	O	O	⊗	O	O	O	⊗	O	O	15° PAV	Gabriel
7 14/08	O	O	O	O	O	O	⊗	⊗	O	O	16° PAV	Gabriel
8 14/08	⊗	O	O	O	⊗	⊗	⊗	O	⊗	⊗	17° PAV	Gabriel
9 20/08	O	O	O	O	O	O	⊗	O	⊗	O	18° PAV	Gabriel
10 20/08	O	O	O	⊗	O	O	⊗	O	O	O	19° PAV	Gabriel
11 28/08	O	O	O	O	O	O	O	⊗	⊗	⊗	20° PAV	Gabriel
12 28/08	O	O	O	O	⊗	O	O	O	O	O	21° PAV	Gabriel
13 03/09	O	O	O	O	O	O	O	⊗	O	O	22° PAV	Gabriel
14 05/09	O	O	O	O	O	⊗	⊗	O	O	O	23° PAV	Gabriel
15 18/09	O	O	O	O	O	⊗	O	⊗	O	O	24° PAV	Gabriel
16 18/09	O	O	O	⊗	O	⊗	O	O	O	O	25° PAV	Gabriel
17 23/09	O	O	O	⊗	O	O	⊗	O	O	O	26° PAV	Gabriel
18 30/09	O	O	O	O	O	O	⊗	O	O	O	27° PAV	Gabriel
19 30/09	O	O	O	O	O	⊗	O	O	O	O	28° PAV	Gabriel
20 08/10	O	O	O	O	O	O	⊗	⊗	O	O	29° PAV	Gabriel
21 15/10	O	O	O	O	O	O	O	O	O	⊗	30° PAV	Gabriel
22 15/10	O	O	O	O	O	O	⊗	O	O	O	31° PAV	Gabriel
23 21/10	O	O	O	⊗	O	O	⊗	O	O	O	32° PAV	Gabriel
24 29/10	X	O	O	O	X	O	O	O	O	O	33° PAV	Gabriel
25												
26												
27												
28												
29												
30												

Conferido pelo Engenheiro:

Data de Conclusão dos Serviços:

Appendix C: INDIVIDUAL FOLLOW-UP SHEET:



		Serviço	
21/10/2019	Segunda - feira	Rebeca	Apt 1302
22/10/2019	Terça - Feira	Rebeca	Apt 1302
23/10/2019	Quarta - feira	Rebeca	Apt 1302
28/10/2019	Segunda - feira	Rebeca	Apt 1302
29/10/2019	Terça - Feira	Rebeca	Apt 1301
30/10/2019	Quarta - feira	Rebeca	Apt 1301
31/10/2019	Quinta - feira	Rebeca	Apt 1301
01/11/2019	Sexta - feira	Rebeca	Apt 1301
02/11/2019	Sábado		
04/11/2019	Segunda - feira	Rebeca	Apt 1301
05/11/2019	Terça - Feira	Rebeca	Apt 1307
06/11/2019	Quarta - feira	Rebeca	Apt 1307
07/11/2019	Quinta - feira	Rebeca	Apt 1307
08/11/2019	Sexta - feira	Rebeca	Apt 1303
09/11/2019	Sábado		
11/11/2019	Segunda - feira	Rebeca	Apt 1303
12/11/2019	Terça - Feira	Rebeca	Apt 1303
13/11/2019	Quarta - feira	Rebeca	Apt 1303
14/11/2019	Quinta - feira	Rebeca	Apt 1701
15/11/2019	Sexta - feira	Rebeca	Fechado
16/11/2019	Sábado		Apt 1701
18/11/2019	Segunda - feira	Rebeca	Apt 1701
19/11/2019	Terça - Feira	Rebeca	Apt 1701
20/11/2019	Quarta - feira	Rebeca	Apt 1701