The Impact of COVID-19 in the A/E/C Industry

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Abstract *— The project establishes a guide that will aid the A/E/C industry in implementing organizational change during times of adversity, such as what is being experienced due to the COVID-19 pandemic, in order to create a proactive approach to problems rather than being reactive. It outlines means and methods implemented by the Coffman Engineers (Honolulu Office) organization that established a beneficial position when dealing with uncertainty. Industry innovative systems and technological advancements are outlined with the importance of implementing diversity in A/E/C organizations and establishing a strong resilient culture foundation to attain a profitable change.*

Key Terms *— A/E/C, Alternative Energy, Market Sector, Pedestrian Simulation Modeling, Performance Based Design, Virtual Enterprises*

INTRODUCTION

The purpose of the project is to assess the impact that was observed in 2020 and 2021 due to the pandemic that was experienced worldwide; specifically for the A/E/C industry and within the Coffman Engineers company (Honolulu Office). The project explored both the negative and positive impacts/outcomes from the unprecedented challenges experienced by reason of the Covid-19 pandemic.

One important factor learned by all, not just the A/E/C industry, is the value of every entity that makes up an organization, whether it be internal or external components. Managers now know the significance of being able to gain control over independent variables by taking proactive actions rather that reactive ones, as the feeling of uncertainty continues to become increasingly ubiquitous.

Considering that the approach taken by the Coffman Engineers (Honolulu Office) has offered predominantly positive outcomes, the objective of the project is to layout a foundation detailing the means and methods used by management that were implemented when dealing with adversity and proved to be effective in order to act as a guide for other A/E/C industry organizations.

LITERATURE REVIEW

By this time there has been extensive research done on the measurable impact caused by the pandemic that consider all aspects and components that make up the A/E/C industry. With drafts and revisions taking place, it is important to reference the most up to date rules and regulations regarding organizational, state, and/or federal guidelines. The long-term effects are still unapparent based on the research being done, but there is no lack of interest in estimating the forthcoming invariable consequences directly or indirectly caused by the pandemic.

Construction was and still is characterized as an essential business, which bolsters the probability of a beneficial organizational outcome by establishing continuous labor and positive income, but it also encompasses the importance of being able to refer to standardized safety guidelines when conducting such work amidst the extent of the pandemic. The most recent guidelines for construction specific recommended practices, published by the Associated General Contractors of America (AGC) and the Occupational Safety and Health Administration (OSHA), can establish a basis of approach which can be applied for most construction industry related labor activities, understanding that there are cases in which certain guidelines may not be considered as a one size fits all.

According to the survey studies conducted by the American Society of Civil Engineers (ASCE),

14% of organizations had an employee with Covid-19 as of March 18, 2020, the rate climbed to 22% by April 9, 2020, and then increased to 25% by May 26, 2020. Also, a majority of 63% of organizations expressed that work from home and social distancing measures were deemed necessary [1]. The increasing values of infected employees indicated by the ASCE demonstrate that the actions being taken by organizations to ensure labor remained "business as usual" were not being effective in combating the effects of the pandemic and it was imperative to establish and implement industry guidelines.

It is important to note that not all construction work was characterized as essential business; only projects that were considered necessary to protect the health and safety of the occupants or those that needed to be finished because it would be unsafe to keep them unfinished were contemplated. Projects such as the construction of healthcare facilities, utility projects, storage projects for housing essential equipment, projects necessary to support law enforcement units or essential workers, among others. The construction industry constitutes about 13% of the global gross domestic product and it is anticipated to grow by more than 70% worldwide by 2025; for the U.S. it accounts for about 4.7% of the total national employment, but this past year caused for 20% of organizations to have withdrawn offers to entry-level employees, 14% faced potential contract penalties due to project delays, and 40% of construction firms were forced to lay off workers because of project cancelations and shortages of equipment and materials [1].

Due to the nature of the project, the research base can be expanded to various industries that can offer insight and leading-edge products which can be associated with the A/E/C industry. The digitalization of the industry is apparent as the market continues to move towards a more technological perspective, thus it is evident that innovative technology is required to be continuously introduced and adapted in order to maintain a competitive edge. The creation of Virtual Enterprises (VE) can overcome geographical constraints and allows businesses to conduct their operations through means of collaboration by consequently exchanging skills and services. "Digitalization defines how digital technologies or IT can be utilized to change current business processes. In digitalization, IT serves as a crucial enabler to seize new business possibilities by changing current business activities, such as business relationship management, communication or distribution" [2]. It is incredible the rate in which technology continues to advance at an exponential rate, considering the near future introduction of quantum computers, there is no telling what is forthcoming. Being able to apply means of VE in any aspect of a business will ensure various important factors of the industry which are favorable productivity rates, market expansion, stakeholder involvement, organizational exposure, collaborative approach, technological assistance, and flexible working conditions.

There is no longer a research and knowledge gap regarding basic actions required to take in order to conduct business activities during the pandemic. The challenges to face are based on the internal decision making that will shape organizational culture and being able to leverage innovative techniques and technologies. The Society for Marketing Professional Services (SMPS) has been able to consistently publish both quantitative and qualitative data by conducting various surveys specifically designed to target responses of interest from professionals working in A/E/C firms as to gauge how they were and are still being impacted by the pandemic.

Started in April 14-28, 2020; 480 industry professionals provided instructive data regarding their personal work experiences. At this stage, 90% reported full-time work from home conditions with 89% of these being employed full-time. 52% saw reduction with ordinary/typical marketing activities, with 39% reporting that it continued "business as usual", and 8% noted that most of all activities were halted. 87% reported they experience reduction in being able to secure typical

projects/clients, and 13% of such indicated that all related activity stopped completely [3].

The most recent survey conducted on the dates of March 30-April 12, 2021 can offer an updated status of the participating firms, with 48% reported full-time work from home conditions, 15% indicating flexible 50/50 work from home/office conditions, and 23% reporting being back in the office full-time. Compelling data reported tackles the question of what the primary strategies for will be developing business moving forward. A majority of 52% indicated that they will be focusing primarily on existing clients, and 45% reporting to be seller-doers; but on the lower end of the spectrum, only 15% reported expanding to new industries, and 13% adding new services [3]. This is excellent data in order to determine how future industry shifts will take place and what internal decisions are being made in response to uncertainty.

METHODOLOGY

Two approaches were considered when determining the project's data collection; a quantitative approach of obtaining systematic and financial data from the Coffman Engineers (Honolulu Office) fiscal year performance, and a qualitative approach which focused on obtaining in-house related data on management practices and office culture impact. Due to the considered timeframe of the objective topic, constantly updated information, and the lack of available publications; a third approach surfaced during the course of the project. The third approach was carrying out extensive research with the objective of acquiring the most up-to-date and relevant information.

The quantitative data contemplated the annual reports from the fiscal year 2019 and 2020. Figure 1 indicates the company wide net revenue for the FY19 showing a total amount of $92,784,466; also, it displays a predicted net revenue value of $102,453,464 for the FY20. Is important to note that the publication of said report was prior to any public news outbreak of the pandemic, but naturally so, with the observed trend of the company's performance, it would be fitting to indicate a constant growth for any future predictive value. Even with an already perception of growth and without taking any adversity into account, the predictive value for FY20 reported on the annual report for FY19 was surpassed. The annual report for 2020 indicated a net revenue value of $103M, showing a 12% increase from the previous year's performance. The data showed that Coffman Engineers surpassed its own expectations which further indicate effective implementation of industry's best practices, impacts, and research directions.

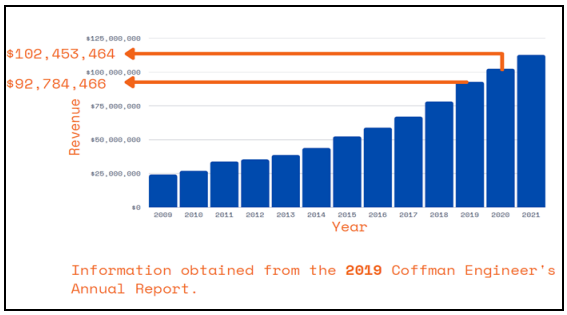

Figure 1
Coffman Engineers – Company Wide Net Revenue

Furthermore, quantitative data was obtained based on employee productivity rates, considering the IT department's contribution of mobilizing 53 office employees to work from home full-time conditions in a span of two weeks as companywide mandates went out. To aid in the transition, a Home Workstation Allotment was issued by the Honolulu office which provided reimbursement for improvements to each employee's home workstation. The allotment considered all options that could be geared towards maintaining a consistent productivity rate. Also, adopting the Microsoft Teams platform ensured continuous engagement and collaboration from all disciplines.

Qualitative data determined business-as-usual evidence with instances of increased performance, an indication that will later be represented on the published annual report. Client outreach was deemed necessary. The client feedback tool software program sent out a baseline survey with

specific questions on quality performance and accessibility in the "new working conditions". This survey took place amidst the span of the initial lockdown restrictions. Overall, the client response indicated no change in quality and responsiveness.

The research focused on the implementation of best practices, theoretical foundations, leading-edge industry growth, and management development. The leading expert's assessments were referenced as a means of gaining a greater understanding of the project subject which in turn allowed for a in depth valuation of the obtained data and the path to proceed with implementing various tools and techniques in the work environment. As a result of the research findings and enhancement recommendations such as the implementation of managerial software tools for management development improved performance, the tool Microsoft Planner was introduced on a single discipline basis in the Coffman Engineers Honolulu office.

RESULTS AND ANALYSIS

A clear indicator of why Coffman Engineers (Honolulu Office) succeeded in overcoming adversity, other that its managerial intuitive decision making, is the serviced market sector and funding sources. Figure 2 displays the way these are sorted and can be a good index of which markets to pursue but, it needs be adjusted as the industry presents shifts.

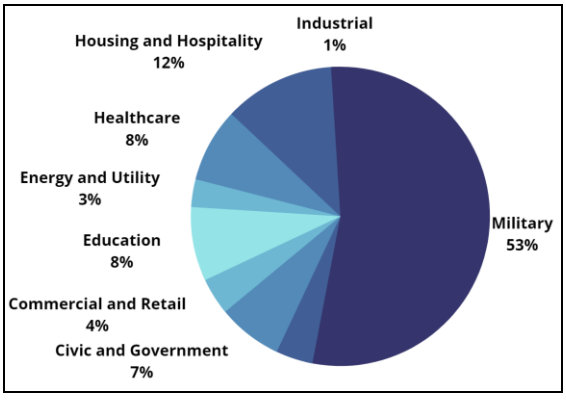

Figure 2
Coffman Engineers (Honolulu Office) – Market Sectors

In March of 2020, the U.S. Army Corps of Engineers in various districts, including the USACE Honolulu District, requested qualifications to provide retrofit/renovation services to convert existing facilities used for alternative purposes (hotels, convention centers, etc.) into COVID-19 overflow clinics and alternative care facilities. The Coffman Engineer's Mechanical discipline was able to address an informal request for assistance in how to manage proper ventilation for arranged tents outside care facilities used for the purpose of testing and holding areas, another indicator of the prospective demand of forthcoming development projects. Introduction of tools and services such as the Pedestrian Simulation Modeling (PSM), led by the Fire Protection engineers, capitalize on the diversity of the Coffman's business strategy. PSM, as used by the life safety team, can identify and confirm how social distancing practices can be achieved by replicating the built environment and developing digital models that replicate best practices such as crowd spacing control, screening, one-way directional travel, and other measures used to satisfy business needs and promote reopening practices that are both feasible and effective [4].

Market diversity can be a strenuous and difficult path with an uncertain rate of return, which is why the data presented by SMPS only showed a reported 15% of organizations expanding to new industries and another 13% electing to add new services [3]. The earnings achieved by successfully introducing a new market sector with increased demand to an organization will subsequentially surpass the initial burden.

Two indicators of this strategy within Coffman, in addition to the previously mentioned PSM, are Alternative Energy and Performance Based Design (PBD). The PBD encompasses out of the box engineering approaches with the intent of rethinking design concepts and achieving project goals through distinct methods. PBD allows for unique design solutions that meet the client's interest by addressing uncommon building conditions, cost reduction, and quantifying system performance. Alternative Energy is a selected

strategic market geared towards pursuing local renewable energy projects in order to grow the aforementioned business sector. Alternative energy is considerably the fastest growing sector, and the pandemic only further accelerated the rate. Being able to standardize system designs and construction can reduce the average costs associated with alternative energy systems as well as implementing PBD, this can provide an edge in the competitive market.

CONCLUSION

The project was able to establish a strong connection of importance in developing effective VE systems, which is why the introduction of managerial software tools such as Microsoft Planner was introduced on a discipline basis for the Coffman Engineers (Honolulu Office). Figure 3 presents an example of how the system is being adopted and the data that can be obtained from it.

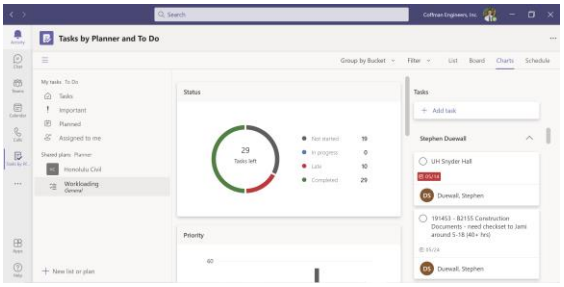

Figure 3

Tasks by Planner and To Do – Civil Engineering Dept.

Based on remarks from the Society of American Military Engineers (SAME) president, communities of interests are shifting their efforts towards aiding in the development of STEM talent with “digital native” skills [5]. The introduction of the management software within the Coffman organization was faced with mixed reviews, most of which were positive, but it is more of an indication of the definition of a new generation that will take place, one which will be capable of embracing and leveraging new technologies. Another implication of VE systems is breaking geographical boundaries. Ten percent of the billable hours for the Coffman Engineers organization (FY 2021) was classified as “shared”, meaning there was a clear collaboration increase among all offices located across the United States.

The nature of the project offers highly based qualitative information which can be perceived as opinionative. The project was designed to offer a guide for managing adversity, it is in no way to be considered as an instructional paper as there are various variables required to considered when choosing to implement organizational change actions. The project can be used to start a discussion and offer possible routes that could lead towards a profitable change.

Recommendations for future research include the development of organizational teams with the purpose of pursuing a desired market and implementing tools and techniques that will aid in acquiring the sector, reporting should heavily consider the rate of return in pursuing such actions.

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