CRITICAL SUCCESS FACTOR (CSF) FOR SHRUB PLANTING WORKS

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ABSTRACT

Quality control plays a vital role in producing an excellent built environment construction work. Landscape development as a major part of the built environment requires at par attentions of quality control in the entire process of development including at the implementation stage. Landscape as an important area in achieving the vision of Malaysia Beautiful Garden in the year 2020 undergoes a long process of development. A thorough monitoring process at the implementation stage is needed to ensure the quality of landscape development end products meets the stakeholders' satisfaction level. Landscape can be divided into two which are hardscape and softscape. Hardscape refers to a hard element in landscape design that stays the same for years. Whereas, softscape refers to the live horticultural elements of a landscape. Natural environment generates a positive point of view on life, making people feel more active and alive (Wolf & Wohlfart, 2014). This statement illustrates that to create a healthy society, it can begin with enhancing natural environment as to build a positive point of view on life. Shrub is one of the common softscape elements in landscape design. Specific critical success factor (CSF) assessment element for shrub planting should be produced to monitor shrub planting work in landscape construction. This paper is prepared to develop critical success factor for shrub planting works in Malaysia. In this study, 225 respondents among Landscape Architects successfully responded to the survey. The survey began with the assessment elements that had to be rated by respondents according to their general assumptions on the critical level of each element. Finally, this research establishes a set of critical success factor of shrub planting. The result shows that there are eight (8) elements assessment for shrub planting works i.e. overall height, leave, cane, soil mixture, planting hole, root ball size, mulching and planting hole finishing, and treatment. The sum of contribution weightage of CSF overall illustrates that leave stands as the highest score, while mulching indicates the lowest score in critical success factor for shrub planting works.

Keywords: *Critical Success Factor, shrub planting, quality construction.*

1. INTRODUCTION

Malaysia is developing to aiming the vision of Malaysia Beautiful Garden Nation by 2020. According to National Landscape Department (2011), the Beautiful Garden Nation is a country where its physical development is balanced with a well-managed green, beautiful and clean environment. Moreover, it is also completed with a unique outdoor space that provides special quality and reflects the identity of Malaysia. Abdullah (2003) cited in Jasasikin (2015) stated that this vision has boosted rapidly the landscape development throughout the country that can be observed in Putrajaya, Cyberjaya and KLCC. Many types of researches have been carried out on the issues of managing construction quality (Abdul Rahman, 2010). However, most of the researchers were conducted as a whole. It is essential to do a research in a narrow scope, mainly to focus on the area of implementation which plays an integral part in construction work. This statement was supported by the previous studies which mentioned that the organization should concentrate more on efficient critical success factors considering their restrictions (Afshin & Gholamreza, 2012). Besides, Jasasikin (2015) mentioned that in 2006, Construction Industry Development Board (CIDB) has established Quality Assessment System in Construction (QLASSIC) as a tool to measure the quality of construction works. However, the study found that construction for landscape works were not included as part of the tool developed by CIDB. Based on previous studies, it is important to study construction quality control as a whole. Plus, more specific studies must be developed to improvise construction quality particularly in Malaysia. There are five categories of softscape which are tree, shrub, palm, ground cover and climber. This study will focus on shrub planting works. The result of the study would help to guide QLASSIC in addressing assessment and can be a reference in the process of the quality management betterment for landscape work in Malaysia.

This study aims to develop critical success factors for shrub planting works in Malaysia. Besides, this study has used a mixed-method approach based on the analysis of quantitative and quantitative data collected. The study also has managed to obtain 225 respondents out of 543 certified Landscape Architects listed under the Institute of Landscape Architects Malaysia (ILAM) based on the questionnaire survey conducted. The outcome of this paper begins with the assessment elements based on a general assumption of the critical level of each element which had to be rated by the respondents. Finally, it will produce a set of critical success factors of shrub planting based on influencing factors. There are four different influencing factors in this study. First, defections on tree growth due to failure in complying with the specification during planting work. Second, duration of time consumption for rectification due to failure in complying with the specification during planting work. Third, the level of cost incurrence on rectification due to failure in complying with the specification during planting work. Finally, the level of workload to rectify the element due to failure in complying with the specification during planting work.

2. CRITICAL SUCCESS FACTOR (CSF) IN CONSTRUCTION

The earlier study on critical success factor was conducted by Ronald D. (1961). The research was about critical success factor as a business guidance. Most of the researchers studied construction quality control as a whole. Therefore, more specific studies must be developed to improvise construction quality. Then, many researchers conducted studies on critical success factors (Walid & Tukel, 1996; Ketelhohn, 1998; Cooke, 2002; Nguyen et al., 2004; Muhammad et al., 2008; Afshin & Gholamreza, 2012; Jasasikin, 2015). Generally, the critical success factor was developed to make an organisation successful Afshin and Gholamreza (2012) mentioned that the organization should concentrate on more efficient critical success factors considering their restrictions. Seven critical success factors for various projects had been listed by Ashley (1986) which were:

i. Construction activities programming

ii. Design planning

iii. Project manager commitment towards the goals

iv. Project team motivation

v. Project manager technical capability

vi. Control system

vii. Definition of work and its field

In addition, a research conducted by Afshin and Gholamreza (2012) on Par Garma Company stated that it was obvious that identifying and ranking the critical success factors of this supreme company, which works in various fields like construction of dam, irrigation and drainage networks, road construction bridge construction, tunnel excavation, construction of concrete and metal heavy building, and mass construction of the residential buildings in cooperation with Ministry of Defence, Road and Urban Development, Energy, Oil, Social Security Organization, Organization of Construction

Engineering and Tehran Municipality, could result in achieving reliability and more desirable record, and lead to organization's more success. Moreover, they also mentioned that there were differences in priorities and weightages founded on critical success factor in construction. According to this research, quality assessment elements would be established with the weightage depending on the critical level of every element in ensuring quality for shrub planting works.

2.1 Landscape Construction

Motloch (2000) stated that landscape construction was part of the scope of work in landscape architecture field beside planning, designing and facilities operation. Landscape construction could be separated into two types which were hardscape and softscape. In an earlier study by Ambrose and Brandow (1992), it was mentioned that softscape works consisted of reshaping the ground surface, replacing some surface materials, and introducing new plantings. For hardscape, it involved structures. This research would emphasise more on a softscape material that is shrub planting. Shrubs play an important element in the construction of garden and landscape areas. Garis Panduan Landskap Negara Edisi 2 (2008) also known as the National Landscape Guideline (NLG) is produced by National Landscape Department to define softscape materials such as trees, shrubs, ground covers and another plant that have to be provided by the contractor. Usually, plant materials can be differentiated according to their sizes.

2.2 Soft-scape Construction (Shrubs Planting Works)

According to Jasasikin (2015), the NLG was divided into nine subtitles according to a parameter of planting works and category of plant materials. There were nine (9) categories of the specification for softscape construction that had been used for landscape projects in Malaysia. This research would deeply study the shrub as a softscape element. Below is the shrub planting procedure list:

2.2.1 Plant Selection

Normally, planting selection is based on specifications provided by consultant or landscape. A list of a plant which contains the name of species, quality and trunk height is provided. Trunk diameter, container/poly-bag size stipulated in planting plan is produced by the consultant and approved by the client. At this early stage, it is a must to do a nursery visit before the actual planting date to make sure the readiness of plant materials according to the specifications.

2.2.2 Transporting the Plant

Transporting the plant material to the site is another critical issue in a planting procedures process. Planting material should be handled according to a proper procedure. Moreover, this procedure of transporting plant material is needed to prevent damages to plant material during the process. National Landscape Department of Malaysia (NLD) has listed the guidelines for plant transporting in National Landscape Guideline (NLG) to ensure the quality of plant can be maintained in the process of transporting.

2.2.3 Site Nursery

Next, site nursery is a place to temporarily store plant material in the earlier stage before planting on site. According to Gary (2013), "plant cannot be planted right away to be placed in a shaded area and keep the roots moist". Besides, another reason for organising site nursery is to acclimatise plant material with the new environment of the site. At the site nursery, there is a monitoring process to ensure a good condition of the plant is maintained.

2.2.4 Receiving Plant on Site

Transporting plant from nursery to the site takes a long time to be completed. The plant material condition may be ruined during this time. Therefore, when plant material reaches a site, it is important for the client to inspect once again the quality of plant material to ensure only the proper quality of plant material will be accepted on the site.

2.2.5 Preparation of Planting Hole

Before plant material reaches the site, planting hole should be prepared. In NLG, it is stated that the preparation of planting hole should follow the configuration stipulated in the specification. The planting holes are dug deep and fairly narrowed to accommodate root balls. The reason is because of the misconception that most shrubs developed deep taproot. NLG has listed down the guideline for specific measurement of planting hole according to plant types. Gary (2013) mentioned "at least twice as wide as the root ball will encourage rapid growth of plant".

2.2.6 Setting Up the Shrub in the Planting Hole

Next, after the preparation of planting hole the shrub should be carefully placed in the planting hole with the acceptable upright position of the trunk. The position of root ball must be in the middle of the planting hole, and the

depth of root ball should be at the position where the trunk flair will be visible when planting work is completed. It is important to place the shrub in the planting hole, so it is slightly higher than the level it is growing in the nursery (Ophardt & Hummel, 2011).

2.2.7 Backfilling

Backfill soil can be formed into original soil dug up from planting hole or a new soil mixture imported from the nursery. This process should be implemented after the setting out of a shrub in the planting hole and the installation of staking. Moreover, the new soil mixture with the ideal condition can be introduced, or remediation of soil should be done, if the soil condition at the site has been altered during construction work and retreat from natural condition. There are twelve important soil characteristics which are texture, structure, porosity, plant-available-water holding capacity, infiltration, drainage, organic matter, soil organisms, pH, nutrient content, soluble salt and contaminants referred from Craul (1999) in Thomas J.N. (2007).

2.2.8 Mulching

Montenegroa et al. (2013) mentioned that mulching reduced significantly peak discharge and runoff, and resulted in a significant increase in soil moisture. In planting establishment, there are two types of mulching: organic mulching and inorganic mulching. Decomposed materials such as coconut pit, wooden sawdust and others are examples of organic mulch, whereas, inorganic mulch is a material that does not decompose over time such as geotextile and landscape fabric.

2.2.9 Site Management for Shrub Planting

The adaptation of the species to a particular environment in which they are developed, the quality of planting stock, site preparation, planting methods and aftercare is an indicator to the performance of plants in the landscape. According to Fini and Ferrini (2011), to ensure that site conditions are appropriate for the plants in pursuing the sustainable approach to urban greening. nonetheless, a less ideal site can be modified to enhance plant performance and development, and ease of maintenance. There are several factors that must be highlighted at this stage which is an amendment of soil physical properties, altering soil chemical properties and management of organic matter. All these plant procedures will ensure to support a healthy plant development. As mentioned above, this research will deeply study on the shrub as a softscape element.

2.3 Plant Anatomy

According to Jasasikin (2015), plants are self-regulating biological creation. They have the ability to regulate themselves by distributing the mechanical stress evenly throughout the structural bodies. The part of shrub experiences mechanical stress such as from the weather or its own weight. Based on Dean and Long (1986) see in Jasasikin (2015), Metzger mentioned the following about the defence mechanism: "the size of the stem at any point varies so that the bending stress due to the wind remains constant." Moreover, Mattheck (2000) briefly explained about five aspects of the self-regulating defence mechanism. First, the distribution of stress is even at all surface area of the plant. Second, an aspect of this self-regulating defence mechanism is that there are no areas that carry too much or too little load. The third aspect is the vigorous growth of cambium as a result of mechanical stress. Next, the fourth aspect is related to the internal structure of the shrubs. Finally, the mechanical stress influences the way a shrub grows. Based on the statement, it is necessary to study plant anatomy of a shrub to understand the natural defence ability of plant towards mechanical stress. There are seven elements that need to be studied for shrub plant anatomy, which are:

2.3.1 Formation of crown

Crown is the leaves and branches of a shrub measured from the lowest branches on the trunk to the top of the shrub (Gilman & Lily, 2002). This statement clearly explains the differences between crown and canopy. The canopy can be assigned to the part of the crown with its twigs and leaves. There are two parts of the crown which are shoots and buds. For shrub planting works, the formation crown of the shrub will be inspected when receiving the shrub on the site. All elements of shrubs crown formation will determine the condition of shrub to be accepted.

2.3.2 Leaf

Leaves are the engine converting energy in plant. Cecie and Ralph (2008) mentioned that the chloroplasts within the leaves have the ability to convert sunlight or other sources of light energy into chemical energy that can be utilised by the plant to live and grow. The condition of leaves will be inspected upon receiving the shrub on site or at nursery, regarding to shrub planting work. The quality of shrub will be accepted based on the physical condition of leaves.

2.3.3 Crown

A shrub can be divided into its trunk and its crown. There are four criteria to determine the overall form or shape of a shrub: a) the position if its terminal or lateral buds, b) the bud break pattern on the trunk and many branches, c) the angle of branches origin and d) the growth of buds and branches. A good example stated by Richard et al. (2004), the absence of lateral buds in most of the arborescent monocots (e.g., palms), leads to a columnar growth habit in which an unbranched trunk ends in a tuft and leaves. Generally, the crown shape will tell the quality and the stability of shrubs. All shrub will have their own natural shape of crown. Sometimes, the abnormality of crown shape indicates the inappropriateness of the surrounding environment throughout the growing process and affects the quality of shrub to be accepted for shrub planting work.

2.3.4 Root

Root is an important element of shrub because it functions as the anchor to hold the shrub strongly on the ground. In reality, the root holds several functions in sustaining the shrub externally as well as internally. Normally, roots grow based on the genetic of the plant species, the roots form, function, size and development of a shrub are also affected by its surrounding environment and condition (Richard et al., 2004). The growth of root is irregular and unpredictable. It is different from the shoot tip that has no sort of protection. Benfey and Scheres (2000) mentioned that the root tip is protected by a layer of root cap that may also help to lubricate the penetration of the root into the ground as the old cells on the root tip die off. Similar to shoot tip, the root tip also possesses the apical meristem. In general, for shrub planting operation, root ball size, soil organism of root ball, root growth pattern, root network and overall root condition need to be monitored to ensure the quality of shrub to be planted.

2.3.5 Branch attachment

The major progress of shrub development is the attachment of branch to stems and it can be seen from mechanical and biological perspectives. The connection of trunk and brunch must allow a two-route exchange of materials, water and other organic compound. Besides, the connection must supply mechanical support to a continually extending beam. Jennifer (2010) mentioned that the structure of the branch attachment then becomes both as transport and support system. Normally, there are three processes involved in this element which are photosynthesis, respiration and transpiration.

2.3.6 Growth factor

The growth characteristic of shrub is complex as shrub does not develop arbitrarily and in a foreseeable manner by following strict principles. It can be explained by a number of processes to determine shrub growth, which is controlled by epigenetic and genetic factors that react dynamically to environmental condition. Bittebiere (2014) illustrated the factors that influence the shrub growth, which are genetic control, environmental control, time and plant growth regulators.

3. METHODS

This study used a mix-method approach which included an analysis of qualitative and quantitative data collection. Quantitative method was used for developing an initial list of critical success factor for shrub planting works. Then, supported by a qualitative method using survey and validation of the results at the end stage of this study. The followings were the types of data collection techniques involved in this research.

3.1 Literature Review

According to Merriam (1998), literature review will help to identify the major study and theories of the research. The main aims and objectives of the research proposal were to guide the process of developing literature review and supported by data collection later. Furthermore, the literature review was a collection of secondary data. The collections of secondary data of shrub planting work elements had been covered as a background of this research in finding the information and idea. The study had been carried out based on construction quality assessment in Malaysia. Throughout the study of the construction quality assessment, the basic elements of assessment were determined. Therefore, landscape specification had been collected from several agencies. Thus, this study was conducted to investigate quality control of shrub planting in Malaysia based on their CSF.

3.1.1 Document Sources

Relevant documents about shrub planting works from selected government agencies had been gathered for comparison. There were three parties involved in comparison method to identify the similarities and differences of shrub planting work elements which were National Landscape Department (NLD), Canadian Nursery Landscape Association (NLA) and America Nursery Landscape Associate (NLA). These government agencies had studied and produced their own element assessment for shrub planting work as a guide

in choosing an excellent quality of shrub. As mentioned earlier, a qualitative method was used to validate the result of the study through a triangulation analysis between the finding of literature review, finding of survey result and finding of interviews. Whereas, quantitative method was applied to the development of critical success factors.

3.1.2 Developing Questionnaire

Development of questionnaire was based on preliminary studies conducted. Then, secondary data collected were the basis of questionnaire development. The questionnaire was designed to collect the experts' opinions on the critical level of elements in softscape construction. It consisted of a list of assessment element to be ranked by respondents based on critical success factors using Likert-Scale 1 to 5. The number indicated the critical level of every element in softscape work. There were four sub-sections separated according to different influencing factors which were defection on shrub growth due to failure in complying with the specification during planting work, duration of time consumption for rectification due to failure complying with the specification during planting work, level of cost incurrence on rectification due to failure in complying the specification during planting work and level of workload to rectify the element due to failure in complying with the specification during planting work.

3.1.3 Sampling Procedure

The data collection was conducted with an expert group in quality control of shrub planting in Malaysia. Respondents of the survey were among Landscape Architect listed in Institution of Landscape Architect Malaysia (ILAM) directory 2008/2009 (ILAM, 2009). There were 225 out of 543 respondents successfully answered the survey conducted. According to Yamanae (1973), the number of respondents from the population of 500 should be at the minimum of 222. The list of the landscape architect in ILAM directory was arranged according to the sequence of membership numbers. The survey started with Landscape Architect number one in the list and followed by Landscape Architect number three on the list and so on. If the researcher failed to reach any intended Landscape Architect, the selection was moved to the next number of the person. The process continued until the last number. Next, the researcher moved on by starting with the person who had been left unattended on the first round survey. This process continued until the last person on the list. The survey was mainly conducted by mailing to the respondents based on addresses stated in the ILAM directory. Before sending out the survey, confirmations of the respondents' addresses had been made through telephone calls. Besides, for respondents who were reachable by the researcher, the survey forms were given by hand and they were asked to answer the survey immediately or return it via mail.

3.1.4 Contribution Weightage Formula

The study had calculated the score of assessment elements based on Contribution Weightage Formula (CWF) in order to generate weightage for CSF. For this study, CWF was a summation of a number of respondents who had chosen the specific assessment element with certain contribution towards CSF.

Contribution Weightage = $\sum$ [(Number of Respondents) x (DCTCSF)]

DCTCSF= Degree of Contribution Towards Critical Success Factors

3.1.5 Research Framework

The following diagram shows the research framework that was conducted for this study.

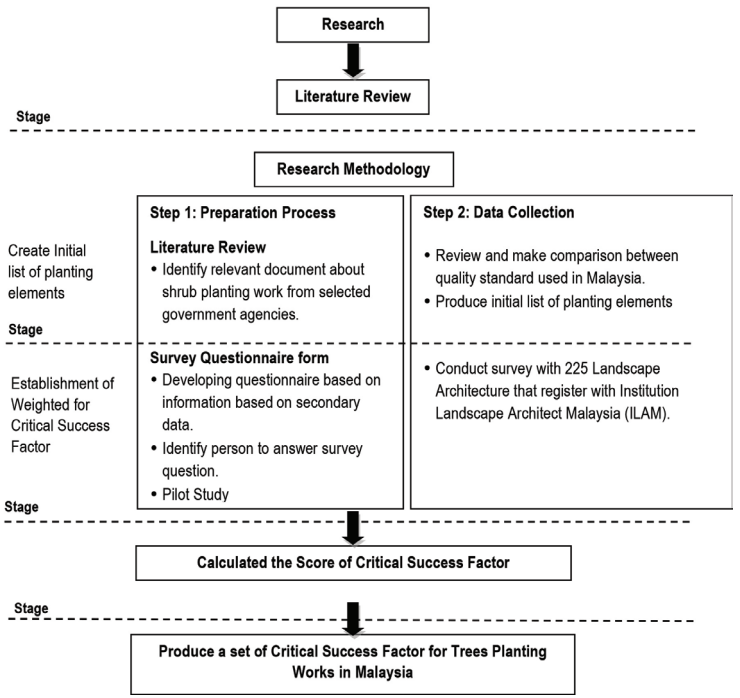

Figure 1: Research Framework

4. RESULTS AND DISCUSSION

This stage illustrates the analysis and the synthesis of data collected from the survey. It comprises the results and the findings pertaining to quantitative and qualitative data. The analysis has been categorised into three parts which are a pilot study, general frequency of socio-demography of the respondent and comparison on the critical success factor rating on eight (8) elements of assessment. At the early stage, a pilot study was done to determine the internal consistency of the questionnaire. The questionnaire was distributed to thirty respondents among experts in landscape field for the purpose. The analysis began with the rating given to assessment elements in general without the presence of influencing factors. Then, it was followed by the weightage comparison of critical success factors based on influencing factors. There were four influencing factors: defection on shrub growth due to failure in complying with the specification during planting work, duration of time consumption for rectification due to failure in complying with the specification during planting work, level of incurrence on rectification due to failure in complying with the specification during planting work and level of workload to rectify the element due to failure in complying with the specification during planting work. In the findings and discussion, the rank and contribution weightage of planting work elements will be highlighted.

4.1 Contribution Weightage Formula of CSF

Contribution Weightage Formula was applied to demonstrate the degree of contribution on CSF of shrub planting assessment elements. For this research, Contribution Weightage Formula was a summation of the number of respondents who had chosen the specific shrub planting construction elements with a certain contribution towards critical success factors. There are five results of contribution weightage formula based on four influencing factors which are level of defection, duration of time consumption, level of cost incurrence, level of workload and finally, the sum of contribution weightage of CSF on overall.

Table 1: Contribution Weightage of CSF – Level of defection

Elements	Degree of weightage contribution toward CSF					Total weightage
	1	2	3	4	5	
Leave	1(1)	0(0)	21(63)	155(620)	48(240)	**924**
Flower	2(2)	4(8)	22(66)	153(612)	44(220)	**908**
Canes	2(2)	2(4)	28(84)	147(588)	46(230)	**908**
Root ball size	0(0)	3(6)	39(117)	145(580)	38(190)	**893**
Overall height	4(4)	4(8)	33(99)	156(624)	28(140)	**875**
Soil mixture	1(1)	34(68)	106(318)	76(304)	8(40)	**731**
Planting hole	1(1)	33(66)	108(324)	76(304)	7(35)	**730**
Finishing & treatment	1(1)	41(82)	94(282)	82(328)	7(35)	**728**
Mulching	0(0)	38(68)	110(330)	70(280)	7(35)	**713**

Table 1 indicates the level of defection as an influencing factor, it was found that leave was the top critical success factor with weightage (924), followed by flower (908) and canes (908). The three lowest critical success factors were planting hole (730), finishing & treatment (728) and mulching (713).

Table 2: Contribution Weightage of CSF – Duration of time consumption

Elements	Degree of weightage contribution toward CSF					Total weightage
	1	2	3	4	5	
Overall height	0(0)	4(8)	30(90)	73(292)	118(590)	**980**
Leave	0(0)	5(10)	31(93)	86(344)	103(515)	**962**
Canes	0(0)	3(6)	42(126)	85(340)	95(475)	**947**
Flower	0(0)	3(6)	37(111)	109(436)	76(380)	**933**
Finishing & treatment	0(0)	14(28)	53(159)	61(244)	97(485)	**916**
Root ball size	2(2)	4(8)	56(168)	140(560)	23(115)	**853**
Planting hole	0(0)	25(50)	105(315)	91(364)	4(20)	**749**
Soil mixture	1(1)	26(52)	105(315)	89(356)	4(20)	**744**
Mulching	1(1)	28(56)	124(372)	71(284)	1(5)	**718**

Table 2 illustrates the contribution weightage of critical success factor on duration of time consumption to rectify the elements. It indicates that overall height scored the highest weightage (980), followed by leave (962) and canes (947). The moderate weightage were scored by flower (933), finishing & treatment (916) and root ball size with the total weightage of 853. Meanwhile, planting hole (749), soil mixture (744) and mulching (718) showed the lowest weightage.

Table 3: Contribution Weightage of CSF – Level of cost incurrence

Elements	Degree of weightage contribution toward CSF					Total weightage
	1	2	3	4	5	
Leave	0(0)	2(4)	38(114)	82(328)	103(515)	**961**
Overall height	0(0)	1(2)	32(96)	102(408)	90(450)	**956**
Canes	0(0)	2(4)	49(147)	78(312)	96(480)	**943**
Flower	0(0)	3(6)	40(120)	104(416)	78(390)	**932**
Finishing & treatment	0(0)	5(10)	43(129)	107(428)	70(350)	**917**
Root ball size	0(0)	4(8)	48(144)	139(556)	34(170)	**878**
Soil mixture	0(0)	13(26)	67(201)	132(528)	13(65)	**820**
Planting hole	0(0)	16(32)	93(279)	112(448)	4(20)	**779**
Mulching	0(0)	43(86)	126(378)	55(220)	1(5)	**689**

For the contribution weightage of critical success factor for the level of cost incurrence, leave stated the highest score of critical success factor (961) and followed by overall height (956) and canes (943). Meanwhile, the two lowest critical success factors score were planting hole (779) and mulching (689). Refer Table 3.

Table 4: Contribution Weightage of CSF – Level of workload

Elements	Degree of weightage contribution toward CSF					Total weightage
	1	2	3	4	5	
Planting hole	0(0)	2(4)	24(72)	78(312)	121(605)	**993**
Canes	0(0)	1(2)	20(60)	91(364)	113(565)	**991**
Root ball size	0(0)	1(2)	16(48)	112(448)	96(480)	**978**
Overall height	0(0)	1(2)	25(75)	102(408)	97(485)	**970**
Flower	0(0)	2(4)	25(75)	102(408)	96(480)	**967**
Leave	0(0)	1(2)	19(57)	121(484)	84(420)	**963**
Finishing & treatment	0(0)	5(10)	22(66)	110(440)	88(440)	**956**
Soil mixture	0(0)	9(18)	65(195)	82(328)	69(345)	**886**

Referring to level of workload as an influencing factor, it was found that planting hole was the top critical success factors with weightage (993), followed by canes (991) and root ball size (978). The three lowest critical success factors were finishing & treatment (956), soil mixture (886) and mulching (689). Whereas, the other elements were moderate critical success factors which were overall height (970), flower (967) and leave (963).

Table 5: The sum of Contribution Weightage of CSF on overall

Elements	Contribution Weightage Based on Influencing Factors				Total weightage
	LD	DTC	LCI	LWL	
Leave	924	962	961	963	**3810**
Canes	908	947	943	991	**3789**
Overall height	875	980	956	970	**3781**
Flower	908	933	932	967	**3740**
Root ball size	893	853	878	978	**3602**
Finishing & treatment	728	916	917	956	**3517**
Planting hole	730	749	779	993	**3251**
Soil mixture	731	744	820	886	**3181**
Mulching	713	718	689	689	**2809**

The sum of all four scorings presents that leave attained the highest critical success factor score which is (3810), followed by canes (3789) and overall height (3781). The three high scores belong to flower (3740), root ball size (3602) and finishing & treatment (3517). Meanwhile, the three lowest scores belong to planting hole (3251), soil mixture (3181) and mulching (2809). Refer Table 5.

In overall, the study has produced a set of weighted CFS for shrubs planting works. Weighted CSF will be a basis of quality control for shrubs planting works. The rank of the weighted CSF will set the priority in in handling the shrubs planting work. The priority should be given to the highest score of CFS as it a most critical factor in attaining the optimum quality for overall shrubs planting works. The establishment of weighted CFS also will enable the process of quality control of shrubs planting works through quality assessment exercise. The rank and weighted CSF will be the basis of calculation for the degree of success or quality measurement for shrubs planting works.

5. CONCLUSION

The result of the study concluded that there are some lacking in landscape construction quality control. This research has established a set of critical success factors that facilitates the process of planting work elements for shrub based on critical success factors of every element. Shrub is one type of vegetation in softscape work. It is important to develop a critical success factor for other types of softscape such as palms, perennial, ground cover and grasses. Finally, the knowledge and understanding of the right requirements for elements will be the basis for developing a more reliable specification and critical success factors to be used as a document for softscape quality control.

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REFERENCES

Abdullah A. B. (2003). UcapanPerasmian: Pelancaran Sambutan Hari Landskap Negara, Taman TasikCyberjaya. Mac 3, 2003.

Abdul-Rahman H., Chen W. and Xiang W. Y. (2010). How Professional Ethics Impact Construction Quality: Perception and Evidence in A Fast Developing Economy. *Scientific Research and Essays*. Vol.5(23). (pp. 3742-3749).

Ambrose J. E. and Brandow P. (1992). *Simplified Site Design*. John Wiley & Sons.

Afshin P. and Gholamreza A. (2012). Determining the Critical success factor In Construction Project: AHP Approach. I*nterdisciplinary Journal of Contemporary Research in Business,* Vol. 4(8).

Arditi, D., &Gunaydin, H. M. (1997). Total quality management in the construction process. *International Journal of Project Management,* 15(4), 235–243.

Dana, M. N., Care, P., Maple, R., Oak, S., Oak, W., & Oak, R. (n.d.). PLANTING LANDSCAPE SHRUBS AND SHRUBS Preplant Operations, 1–9.

Dean T. and J. Long (1986). Validity of Constant-Stress and Elastic- Instability Principles of Stem Formation in Pinus contorta and Trifolium pratense. *Annal of Botany.* Vol.58. (pp. 833-840).

Federico, A., Ferrada, X., Howard, R., & Rubio, L. (2014). Risk management in construction projects : a knowledge-based approach. *Procedia - Social and Behavioral Sciences,* 119, 653–662.

Fini A., Faoro M., Amoroso G., Piatti R., Frangi P. and Ferrini F. (2011). Effect of Pruning Type on Growth, Physiology and Breaking Stress of Maple Trees. *Proceedings of the 87th International*. *Congress of the International Society of Arboriculture*. Sydney (Australia). (pp. 23-27).

Garis Panduan Landskap Negara Edisi 2 (2008), *National Landscape Department*. NLD. Malaysia.

Griffith G. K. (2003). *The Quality Technician's Handbook*. Prentice Hall, Inc. McGraw Hill.

Juran J. M. (1995). *The History of Managing for Quality in the United State*. ASQC Quality Press Milwaukee.

Ketelhohn W. (1998). What is A Key Success Factor?. *European Management Journal*. Vol. 16(3).(pp. 335-340)

Merriam, S. B. (1998). Qualitative research and case study applications in education. San Francisco: Jossey-Bass.

Montenegro A. A. A., Abrantes J. R. C. B, De Lima J. L. M. P., Singh V. P. and Santos T. E. M. (2013). I*mpact of Mulching on Soil and Water Dynamics under Intermittent Simulated Rainfall*. CATENA. Vol. 109. (pp.139-149).

Motloch J. L. (2000). *Introduction to Landscape Design*. John Wiley & son.

Mukhtar (2009). QLASSIC, How It Can Benefit an ISO 9001 Certified Contractor. SHEQ MAG. CIDB. Malaysia. (p.15).

National Landscape Policy (2011). *National Landscape Department*. NLD. Malaysia.

Ophardt M. and Hummel R. L. (2011). *Planting Trees and Shrubs in the Landscape*. Washington State University Extension.

Oxford Dictionaries, (online). Available at:
< http://www.oxforddictionaries.com/ms> (6 JANUARY 2018)

Rosniza, A., Akbar, N., Fadhil, M., &Maisyam, M. (2015). *Desirable Characteristics of Malaysian Standard Method of Measurements*
(MySMMs) in Meeting Industry Quality Standards. *Procedia - Social and Behavioral Sciences,* 202(December 2014), 76–88.

Sani, J. A., & Othman, N. (2012). Quality Standard and Specification for Soft-scape Construction in Malaysia. *Procedia - Social and Behavioral Sciences,* 35(December 2011), 260–266.

Walid B., Tukel O. I. (1996). A New Framework for Determining Critical Success/Failure Factors in Projects. I*nternational Journal of Project Management*. 14(3). (p. 141).

Yamanae T. (1973). *Statistic and Introduction Analysis*. *London*. Leonard Hill.

Zatil, S., Syed, H., Mohammad, M. F., & Ahmad, K. (2014). Enhancing the Quality of Construction Environment by Minimizing the Cost Variance. *Procedia - Social and Behavioral Sciences,* 153, 70–78.