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Impact of critical success factors on successful technology implementation in Consumer Packaged Goods (CPG) supply chain

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A B S T R A C T

The purpose of this study is to identify and analyze the impact of critical success factors (CSFs) impacting technology implementation in Consumer Packaged Goods (CPG) supply chain. The study has used existing literature to identify CSFs and then questionnaire-based survey and Exploratory Factor Analysis (EFA) to group CSFs. The paper has revealed that "Inter-Organizational", "Organizational", "CPG Sector Specific", "Human" and "Program Management" CSFs impact successful technology implementation in CPG supply chain. The paper fills the gap in existing literature by studying the impact of CSFs on successful technology implementation in CPG supply chain and providing guidance to practitioners working in CPG sector.

1. Introduction

CPG organizations need to provide wide range of options along with keeping abreast with the changing consumer needs and business scenario (Noorani et al., 2007). CPG organizations are under constant pressure to launch efficient and effective new product innovations (Noorani et al., 2007; Søndergaard et al., 2007) and promotional campaigns (Tang et al., 2014). In order to be competitive in this global environment, CPG organizations have realized the importance of supply chain (Zokaei et al., 2007; Sahay et al., 2002). Organizations need to invest in enabling infrastructure (Marien, 2000) and technology (Sahay et al., 2003) to realize supply chain vision into reality. Technology has become an enabler for an organization's supply chain instead of a weapon of competition (Hong, 2002). Disappointing

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outcomes of technology investment pose a serious challenge (Kim et al., 2006) along with slow adoption of technology in supply chain (Johnston et al., 2000). Hence successful implementation of technology has been a matter of significant discussion.Thus, it is essential for organizations to focus on CSFs and understand the impact of these CSFs on successful technology implementation. The literature on supply chain technology implementation, didn't discuss CSFs pertaining to CPG sector. This has motivated the authors to study CSFs affecting successful technology implementation in CPG supply chain.

The objectives of this paper are to

- identify CSFs from existing literature
- study the impact of CSF's on successful technology implementation in CPG supply chain
- recognize societal and technological impact
- suggest future research directions

2. Research Methodology

2.1 Identification of CSFs for successful technology implementation in CPG supply chain

CSFs for successful technology implementation in CPG supply chain have been identified through extensive literature review. Most of the earlier research has not specifically focused on CPG sector and the research has been broad based. It has been assumed that CSFs identified from ERP implementation and other industries will be applicable for technology implementation in CPG supply chain. In this study, a total of 24 CSFs have been identified which includes 4 CSFs pertaining to CPG sector. The same is presented in Table 1.

Table 1
Critical Success Factors (CSFs)

S.No	Critical Success Factors (CSFs)	References
1	Top Management Support (C1)	Annamalai et al., 2013; Singh 2013; Ngai et al., 2008; Stanley et al., 2006; Bhatti 2005; Favilla et al., 2005; Haleem et al., 2012
2	Organization's willingness and commitment (C2)	Hammant, 1997; Damien, 2005; Kumar et al., 2016
3	Alignment between Information Technology (IT) and business objectives (C3)	Upadhyay et al., 2011; Chang, 2006; Done et al., 2011; Kolbusak-McGee 1998
4	Proper IT investment justifications (C4)	Sandhu et al., 2012; Upadhyay et al., 2011
5	Change management initiatives (C5)	Bozarth, 2006; Saini et al., 2013; Sandhu et al., 2012; Hoffer et al., 1998
6	Trust between supply chain partners (C6)	Paul, 2003; Laeequddin et al., 2012; Anbanandam et al., 2011; Stanley et al., 2008; Norris et al., 2001; Jharkharia et al., 2005; Buxmann et al., 2004; Olorunniwo et al., 2010; Borade et al., 2010; Sahay et al., 2003; Pomponi et al., 2015
7	Cooperation and commitment of supply chain partners (C7)	Fynes et al. , 2005; Flynn et al., 2010; Park et al.,2001
8	Cultural alignment among partners (C8)	Thakkar et al., 2008; Gunasekaran et al., 2013
9	Investment in IT infrastructure by supply chain partners (C9)	Kannabiran et al., 2012; Somuyiwa et al., 2011; Toussea-Oulai, 2007; Thakkar et al., 2008
10	Dynamic information sharing model with supply chain partners (C10)	Stanley, 2008; Norris et al., 2001; Jharkharia et al., 2005
11	Effective governance and program management (C11)	Fawcett et al., 2006; Mandal et al., 2003
12	Effective risk mitigation strategy (C12)	Mandal et al., 2003; Giunipero et al., 2005
13	Preparedness for business process reengineering (C13)	Ngai et al., 2008; Garg et al., 2013
14	Involvement of Employees/ end-users during implementation stage (C14)	Bingi et al., 1999; Holland et al., 1999; Sandhu et al., 2012; Shaaban et al., 2014; McMullan 1996; Upadhyay et al., 2011
15	Proper training of end-users (C15)	Thakkar et al., 2008; Kapp et al., 2001; Ngai et al. ,2008
16	Assurance of job security for employees post IT implementation (C16)	Garg et al., 2013; Daneva, 2007
17	Competence of the project team (C17)	Upadhyay et al., 2011, Stratman et al., 2002; Hashim, 2007
18	Proper information security (C18)	Kannabiran et al., 2012; Borade et al., 2010
19	Selecting the right supply chain package (C19)	McMullan 1996; Annamalai et al., 2013; Sahay et al., 2003
20	Data Management (C20)	Adebanjo et al., 2000; Corney, 2002
21	Gaining competitive advantage (C21)	Altıntas et al., 2010; Noorani et al., 2007; Steele et al., 1994; Korotkov et al., 2013; Tang et al., 2014; Shimp, 2003; Sabir, et al., 2014
22	Peer Pressure (C22)	Kannabiran, 2012; Cragg et al., 2002
23	Involvement of Marketing team during planning phase (C23)	Inman et al.,2009; Korotkov et al., 2013; Rose, 2009
24	Focus on Consumer (C24)	Zokaei et al., 2007; Lowson, 2001

2.2 Survey

A questionnaire based survey has been used to establish relationship between identified CSF's and successful technology implementation. The questionnaire was first sent to 25 respondents (Academicians working as Supply chain experts and Supply Chain & IT executives of CPG organizations) to ensure that questions were appropriate and easy to understand & respond. Based on the feedback received from 25 respondents, 3 questions were dropped and 10 questions were refined.

Questionnaire was then sent to 300 professionals working with CPG organizations at different levels of managerial responsibility. The questions were asked on a five-point Likert scale. On this scale 1 and 5 correspond to "very low importance" and "very high importance" respectively. 210 professionals shared responses but 10 responses were dropped because of incompleteness.

2.3 Data Analysis

Cronbach's coefficient (α) was calculated to test the reliability and internal consistency of the responses. The value of α in this study was found to be 0.816 which is considered acceptable (Cronbach, 1951). Skewness and kurtosis are used to validate the data for normality (Bo et al., 2015). The values of more than ±1 are often taken to indicate non-normality (Hair, 2014). Table 2 presents basic statistics including min, max, standard deviation, Skewness and Kurtosis. The values were well within desirable levels and principle component analysis needs to be used to extract the main factors.

Table 2
Basic statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
C1	200	1	5	3.56	.986	-.296	.172	-.028	.342
C2	200	1	5	3.45	.971	-.121	.172	-.020	.342
C3	200	1	5	3.72	1.004	-.485	.172	-.198	.342
C4	200	1	5	3.66	.948	-.165	.172	-.420	.342
C5	200	1	5	3.66	1.025	-.312	.172	-.340	.342
C6	200	1	5	3.41	.840	-.124	.172	.102	.342
C7	200	1	5	3.35	.842	-.011	.172	-.174	.342
C8	200	1	5	3.24	.770	.036	.172	.171	.342
C9	200	1	5	3.26	.814	.063	.172	-.058	.342
C10	200	1	5	3.30	.796	-.230	.172	.128	.342
C11	200	1	5	3.23	.779	.227	.172	.025	.342
C12	200	1	5	3.23	.823	.052	.172	.093	.342
C13	200	1	5	3.23	.788	.191	.172	-.066	.342
C14	200	1	5	2.88	.954	.138	.172	-.948	.342
C15	200	1	5	3.10	.894	-.103	.172	-.408	.342
C16	200	1	5	2.79	.970	.299	.172	-.521	.342
C17	200	1	5	2.84	.946	.207	.172	-.884	.342
C18	200	1	4	2.72	.672	-.112	.172	-.108	.342
C19	200	1	4	2.62	.719	-.037	.172	-.252	.342
C20	200	1	4	2.70	.696	-.318	.172	.082	.342
C21	200	2	5	4.31	.675	-.764	.172	.670	.342
C22	200	2	5	4.31	.636	-.598	.172	.549	.342
C23	200	2	5	4.33	.636	-.660	.172	.592	.342
C24	200	2	5	4.36	.626	-.695	.172	.735	.342

C1- C24: 24 CSFs

Further Exploratory Factor Analysis (EFA) was done to identify the underlying relationships between CSFs. Table 3 presents Kaiser-Meyer-Olkin (KMO) and Bartlett's test results. KMO is coming to 0.812 and results are statistically significant.

Table 3
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.812
Bartlett's Test of Sphericity	Approx. Chi-Square	2.978E3
	Df	276
	Sig.	.000

We can see from Scree plot (Fig. 1) and Total variance explained (Table 4) that first six factors represent most influential items. The total variance explained by 6 components is 75.8%. Table 5 represents the results of principal component analysis after Promax rotation.

Table 4
Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.346	22.274	22.274	5.346	22.274	22.274	4.235
2	3.822	15.926	38.201	3.822	15.926	38.201	4.374
3	2.718	11.326	49.526	2.718	11.326	49.526	3.294
4	2.599	10.830	60.356	2.599	10.830	60.356	3.062
5	1.974	8.225	68.581	1.974	8.225	68.581	2.560
6	1.736	7.232	75.813	1.736	7.232	75.813	2.787
7	.618	2.574	78.387				
8	.557	2.320	80.707				
9	.471	1.963	82.670				
10	.403	1.681	84.351				
11	.388	1.617	85.968				
12	.379	1.577	87.545				
13	.375	1.563	89.107				
14	.344	1.432	90.539				
15	.325	1.354	91.893				
16	.289	1.206	93.099				
17	.274	1.142	94.241				
18	.247	1.030	95.272				
19	.230	.959	96.231				
20	.224	.933	97.164				
21	.208	.868	98.033				
22	.191	.795	98.827				
23	.145	.605	99.432				
24	.136	.568	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

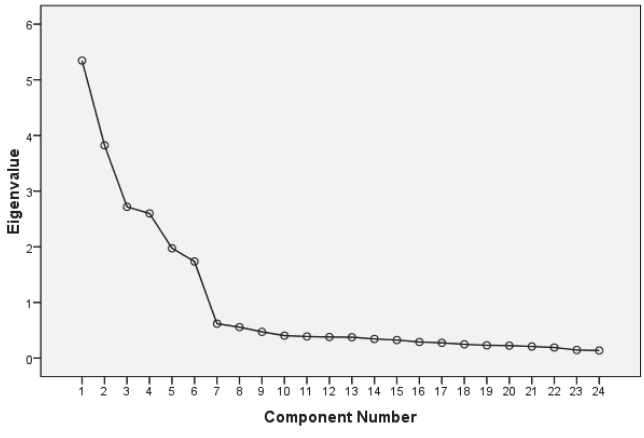

Fig. 1. Scree Plot

Table 5
Pattern Matrix (Principal Component Analysis after Promax rotation)

	Component					
	1	2	3	4	5	6
C1	.865					
C2	.889					
C3	.832					
C4	.901					
C5	.914					
C6		.870				
C7		.849				
C8		.895				
C9		.898				
C10		.879				
C11						.912
C12						.907
C13						.857
C14				.860		
C15				.794		
C16				.844		
C17				.805		
C18					.902	
C19					.897	
C20					.865	
C21			.807			
C22			.894			
C23			.867			
C24			.749			

Extraction Method: Principal Component Analysis.
Rotation converged in 6 iterations.

Based on this, 24 CSFs have been divided into 6 components as depicted in Figure 2. The first CSF extracted from Factor Analysis is "Organizational" and includes 'Top Management Support', 'Organization's willingness and commitment', 'Alignment between IT and business objectives', 'Proper IT investment justifications' and 'Change management initiatives'. The second CSF "Inter-Organizational" extracted from Factor Analysis pertains to supply chain partner parameters, and includes 'Trust', 'Cooperation and commitment', 'Cultural alignment', 'Investment in IT infrastructure' and 'Dynamic information sharing model' between supply chain partners. The third CSF "Program Management" extracted from Factor Analysis includes 'Effective governance and program management', 'Effective risk mitigation strategy' and 'Preparedness for business process reengineering'. The fourth CSF " Human" pertains to factors involving employees and includes 'Involvement of Employees/ end-users during implementation stage', ' Proper training of end-users', ' Assurance of job security for employees post IT implementation' and ' Competence of the project team'. The fifth CSF "Technology" extracted from Factor Analysis includes 'Proper information security', 'Selecting the right supply chain package' and 'Data Management'. The sixth component " CPG Sector Specific" pertains to CPG related parameters and includes 'Gaining competitive advantage', ' Peer Pressure', ' Involvement of Marketing team during planning phase' and ' Focus on Consumer'. Finally, the relationship of these 6 CSFs on successful technology implementation needs to be identified.

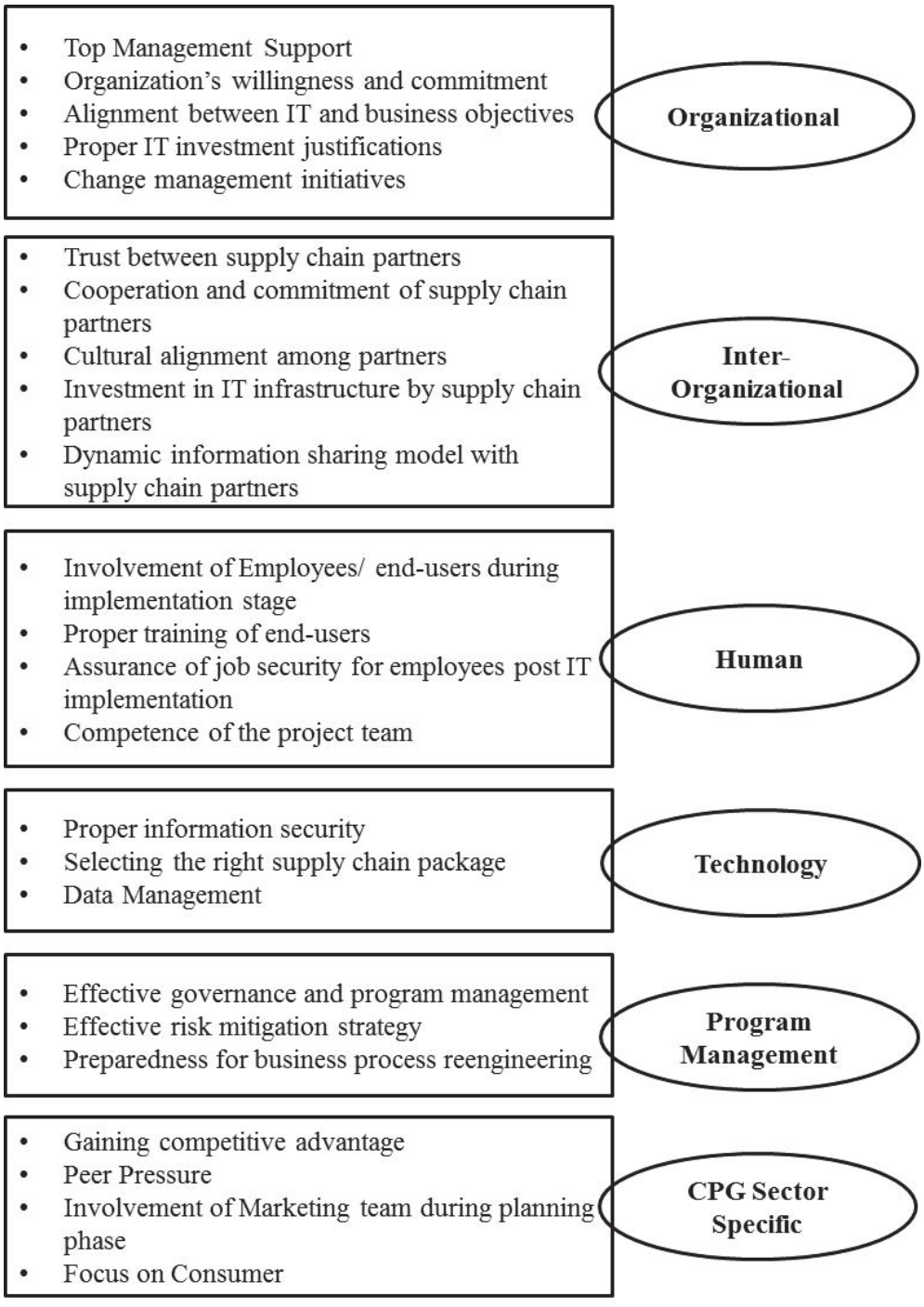

Fig. 2. Critical Success Factors (CSFs) post Factor Analysis

3. Results & Discussion

3.1 Result

In this section, we identify the relationship of these 6 components namely "Inter-Organizational" (I), "Organizational" (O), "CPG Sector Specific" (C), "Human" (H), "Technology" (T) and "Program Management" (P) on successful technology implementation in CPG supply chain. Based on the survey and statistical test conducted, it is suggested that

Implementation Success= .301+ .304 (I) + .299 (O) + .179 (C) + .177 (H) + .137 (P)

The model suggests that I, O, C, P and H have significant impact on technology implementation at 95% significant level and T doesn't have significant impact on technology implementation. The details of our finding, is depicted in table 6 and summary of the results in Table 7.

Table 6
Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
(Constant)	.301	.412		.729	.467					
IMEAN	.283	.057	.304	4.929	.000	.443	.334	.284	.873	1.145
OMEAN	.228	.046	.299	4.984	.000	.386	.337	.287	.921	1.086
CMEAN	.222	.074	.179	2.989	.003	.278	.210	.172	.926	1.080
HMEAN	.146	.049	.177	2.962	.003	.240	.208	.171	.933	1.072
PMEAN	.147	.063	.137	2.326	.021	.098	.165	.134	.951	1.052

Dependent Variable: Implementation Success MEAN

Table 7
Impact of Critical Success Factors (CSFs) on successful technology implementation

"Organizational" CSF's will have positive impact on successful implementation of technology in CPG supply chain	Accept
"Inter-Organizational" CSF's will have positive impact on successful implementation of technology in CPG supply chain	Accept
"Human" CSF's will have positive impact on successful implementation of technology in CPG supply chain	Accept
"Technology" CSF's will have positive impact on successful implementation of technology in CPG supply chain	Reject
"Program Management" CSF's will have positive impact on successful implementation of technology in CPG supply chain	Accept
"CPG Sector Specific" CSF's will have positive impact on successful implementation of technology in CPG supply chain	Accept

3.1 Discussion on findings

From the results obtained, it is found that "Organizational", "Inter-Organizational", "Human" and "Program Management" CSFs will have positive impact on successful technology implementation in CPG supply chain. This is well supported by previous studies done in other industries which states that successful technology implementation requires a committed organization (Hammant, 1997) along with the support from top management (Kotzab et al., 2003; Favilla et al., 2005; Jharkharia et al., 2005) and a sustainable change management system (Bozarth, 2006). Trust between supply chain partners is essential for a successful technology implementation (Laeequddin et al., 2012; Anbanandam et al., 2011; Kotzab et al., 2003). Supply chain technology implementation seem to succeed or fail on the degree of resource sharing (information, knowledge & skills) along with the partner's ability to use these resources effectively in the changing environments (Stanley, 2008; Jharkharia et al., 2005).

Employees play a major role in the implementation (Shaaban et al., 2014) along with expertise of implementation consultants (McMullan, 1996). Employees should understand the rationale for implementation (Garg et al., 2013) along with getting proper training. It is also important to have preparedness for Business Process Reengineering (Favilla et al., 2005) along with using a proven implementation methodology (Favilla et al., 2005), effective governance, program management & risk-mitigation strategy during implementation (Hammant, 1997).

One of the major findings of this study is the positive impact of "CPG Sector Specific" CSF on successful technology implementation. The findings highlight that a) Gaining competitive advantage b) Peer Pressure c) Involvement of marketing team during planning phase and d) focus on Consumer, positively impacts technology implementation. The impact of this CSF has not been studied earlier and this is the first of its kind study which has focused on this CSF along with other CSFs.

The last finding of this study states that "Technology" CSF will not have significant positive impact on successful technology implementation in CPG supply chain. Though, the earlier studies in other sectors have emphasized that implementation success depends on choosing the right technology & product for the organization (Annamalai et al., 2013) along with information security framework (Borade et al., 2010).

4. Conclusion and Implication

The main findings of this research in line with the stated objectives are

- 24 CSFs have been identified from existing literature and then grouped into 6 using factor analysis
- fills the gap in existing literature by focusing on CPG sector as the previous research work in this field lacked focus on CPG sector
- "Inter-Organizational" CSF has higher and more significant impact, followed by "Organizational", "CPG sector specific", "Human" and "Program Management" CSFs on successful technology implementation in CPG supply chain
- emphasized the positive impact of "CPG sector specific" CSF on successful technology implementation in CPG supply chain
- "Technology" CSF doesn't have a significant impact on successful technology implementation in CPG supply chain

The integrated approach suggested practitioners to concentrate on both softer aspects ("Organizational", "Inter-Organizational", "Human", and "Program Management") along with "CPG sector specific" CSF which will help in delivering enhanced outcomes and improved performance. It also provides guidance to managers by focusing on high priority CSFs "Inter-Organizational", "Organizational", "CPG sector specific" and "Human" (in order of priority from high to low).

The proposed study has some limitations which can be undertaken in future research. Structural Equation Modeling (SEM) can be applied to further test the validity of this model. This research has been done for CPG sector and similar research needs to be done for other sectors.

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