

کهرهستهی بیناسازی بهردهوام و ته‌ه‌ده‌دیاتی بهردهوامی له عیراقد

پیشه‌کی:

کهرتی بیناسازی به‌کیکه له هۆکاره گهوره‌کانی تیکچوونی ژینگه، به شیوه‌یه‌کی سه‌ره‌کی به‌هۆی به‌کاره‌ینانی سه‌رچاوه سروشتیه‌کان و به‌ره‌مه‌ینانی پاشماوه. به‌رده‌وامی زیاتر و زیاتر له باوه‌ش ده‌گیریت، به تابه‌ت له شوینه چره‌کانی ناوه‌دان‌کردنه‌وهی وه‌ک عیراق، خواست له‌سه‌ر شیوازی بیناسازی به‌رده‌وامی زیاد ده‌کات. جگه له که‌م‌کردنه‌وهی کاریگه‌ری نه‌رینی له‌سه‌ر ژینگه، بیناسازی به‌رده‌وامی کاریگه‌ری نه‌رینی له‌سه‌ر دادپه‌روه‌ری کۆمه‌لایه‌تی و نیم‌کانی نابووری له فه‌زای ژیاندا هه‌یه (مه‌حجوب و هاوکارانی، ۲۰۲۳). به‌کاره‌ینانی ته‌کنه‌لوژیای دا‌هینه‌رانه و کهره‌سته‌ی سه‌وزی به‌سه‌ود که له بینای عیراقد له‌سه‌ر زۆر باب‌ه‌تی په‌یوه‌ست به به‌رده‌وامی لهم وتاره‌دا لیکۆلینه‌وه‌یان له‌سه‌ر ده‌کریت. باسه‌که به شی‌کردنه‌وهی گرنگی پراکتیزه به‌رده‌وامیه‌کان بۆ که‌م‌کردنه‌وهی پیسبوون و پشت‌گیریکردن له کارایی سه‌رچاوه‌کان ده‌ست‌پیده‌کات. پاشان لیکۆلینه‌وه له مه‌ودای نه‌وه که‌ره‌سته بیناسازی به‌ ژینگه‌دۆستانه ده‌کات که به‌رده‌ستن، ناماژه به‌وه ده‌کات که چون له‌وانه‌یه پراکتیزه ناساییه‌کان تیک‌بدن. سه‌ره‌رای نه‌وه‌ش، سه‌ره‌رای نه‌م سه‌ودانه، پرسه یاساییه‌کان و سنووردارکردنی ژیرخانی، وا ده‌کات که عیراق له‌را‌ده‌به‌ده‌ر قورس بیت بۆ وه‌رگرتنی پراکتیکی به‌رده‌وامی (مه‌جید، ۲۰۲۳).

هه‌روه‌ها وتاره‌که لیکۆلینه‌وه له ریساکانی حکومه‌ت ده‌کات که یارمه‌تی ده‌ست‌پیش‌خه‌ریه‌کانی بیناسازی سه‌وز ده‌دن و (۱) چون ته‌کنه‌لوژیای مؤدیرنه‌کان ده‌توانن پشت‌گیری له ریبازه‌کانی بیناسازی به‌رده‌وامی بکه‌ن. له کۆتاییدا تو‌یژینه‌وه‌ی که‌یسی تو‌یژینه‌وه سه‌رکه‌وه‌تووه‌کانی به‌رده‌وامی له عیراقد له‌خۆده‌گریت، که نیشان ده‌دات چون ده‌توانریت نه‌م بیرو‌کانه به شیوه‌یه‌کی کرده‌یی له بارودۆخی روژانه‌دا به‌کاربه‌ینریت. سه‌رنجی نه‌م وتاره له‌سه‌ر گرنگی به‌رده‌وامی له رووبه‌رووبوونه‌وه‌ی ناسته‌نگه‌کان و پیش‌خه‌ستی ناسۆکانی کهرتی بیناسازی عیراق (2) به پیش‌که‌ش‌کردنی شی‌کاریه‌کی ورد بۆ نه‌م پرسانه. وه هیوا‌یه‌کی گه‌وره هه‌یه بۆ پیش‌که‌وتنی له‌وه شیوه‌یه، بۆ نمونه ده‌رفه‌تی گه‌شه‌پیدان زۆره. به‌لام دادپه‌روه‌رانه ناماژه به‌وه بکه‌ین که (3) کۆمه‌لێک پرس، وه‌ک سنووردارکردنی دارایی و به‌ربه‌ستی ریک‌خراوه‌یی، ره‌نگه ریبگری لهم جو‌ره باش‌ترکردانه بکه‌ن. که‌واته پیویسته ریبازه دا‌هینه‌ره‌کان تا ده‌توانریت به‌بخرین

گرنگی پراکتیکه‌کانی بیناسازی به‌رده‌وامی:

پراکتیکه‌کانی بیناسازی به‌رده‌وامی له چوارچیه‌یه‌کی وه‌ک عیراقد که نوژنه‌کردنه‌وه به‌په‌له پیویسته، مرۆف ناتوانیت به که‌متر جه‌خت‌کردنه‌وه باس له گرنگیه‌کانیان بکات. بیناسازی به‌رده‌وامی نه‌وه پراکتیکانه له‌خۆده‌گریت که کاریگه‌ریه نه‌رینییه‌کانی ژینگه‌یی سنووردار ده‌کهن و له هه‌مان کاتدا سه‌ودی کۆمه‌لایه‌تی و نابووری پیش‌که‌ش ده‌کهن. له نه‌نجامی پیگه‌ی نیستای عیراق له پیوه‌ره‌کانی نه‌دای ژینگه‌یی، کهرتی بیناسازی ره‌نگه به وه‌رگرتنی نه‌م شیوازانه به‌ره‌مه‌ینانی پاشماوه و به‌کاره‌ینانی سه‌رچاوه‌کان به شیوه‌یه‌کی به‌رچاو که‌م بکاته‌وه (مه‌حجوب و هاوکارانی، ۲۰۲۳). له کاتی‌کدا که کوالیتی ژیانی کۆمه‌لگه‌کان زیاتر به‌رز ده‌کهنه‌وه، ریبوشینه به‌رده‌وامیه‌کان نیگه‌رانیه‌کانی لیکۆلوژی‌ش چاره‌سه‌ر ده‌کهن و به‌م شیوه‌یه‌ش بارودۆخی ژیانیه سه‌لامه‌ت‌تر و ته‌ندروست‌تر مسۆگه‌ر ده‌کهن.

جگه له‌وه‌ش، بیناسازی به‌رده‌وامی خۆراگری نابووری به‌هیز ده‌کات له‌رینگه‌ی باشت‌کردنی به‌کاره‌ینانی سه‌رچاوه‌کان و ورده‌ورده تیچووی چاک‌کردنه‌وه. به‌به‌کاره‌ینانی دیزاینی وزه‌کارامه (و که‌رسته)، لایه‌نه په‌یوه‌ندی‌داره‌کان ده‌توانن که‌متر خه‌رج بکه‌ن بۆ خزمه‌ت‌گوزارییه‌کان و ته‌مه‌نی بینا‌کان درێژ بکه‌نه‌وه (مه‌جید، ۲۰۲۳). عێراق پیویستی به‌م توانایه‌ نابوورییه‌ هه‌یه بۆ نه‌وه‌ی ژیرخانی خۆی دوا‌ی چه‌ندین ساڵ له‌ شه‌ر بگه‌رێنێته‌وه. سه‌ره‌رای نه‌وه، تیکه‌ل‌کردنی لایه‌نه کۆمه‌لایه‌تییه‌کان له‌ پراکتیکه به‌رده‌وامه‌کاندا هاتده‌ری به‌شداریکردنی ناوخۆییه له‌ پرۆژه‌کانی بیناسازی و په‌روه‌رده‌کردنی یه‌کسانی له‌ناو کۆمه‌لگانه‌کاندا له‌رینگه‌ی دروست‌کردنی هه‌لی کار له‌ ته‌کنه‌لوژی سه‌وزه‌کاندا. هه‌روه‌ها گۆرانکاری بۆ شیوازه‌کانی بیناسازی ژینگه‌دۆستانه هاتو ته‌ریبه له‌گه‌ل بزوتنه‌وه جیهانییه‌کان که که‌م‌کردنه‌وه‌ی کاریگه‌رییه‌کانی گۆرانی که‌شوه‌هوا له‌ پیشینه‌ی کاره‌کانیاندا‌یه. جیهان له‌گه‌ل قه‌یرانیکی‌دا‌یه له‌ ژینگه‌دا به‌لام بۆ ولاتی وه‌ک عێراق که‌ بێ گومان به‌ره‌و‌رووی هه‌ندیک توخم ده‌بنه‌وه که گۆرانی که‌شوه‌هوا هیناویه‌تییه ناراه، وه‌رگرتنی پراکتیزه به‌رده‌وامیه‌کان له‌ پیش هه‌موو شتی که‌وه‌یه. له‌ هه‌مان چوارچێوه‌دا، ناگادارکردنه‌وه‌ی لایه‌نه په‌یوه‌ندی‌داره‌کان له‌ سووده به‌رده‌وامه‌کانی به‌رده‌وامییه‌ گرنه‌گه. له‌وه‌ش گرنه‌گتر، نه‌م گۆرانکارییه یان گۆرانکارییه داوا‌ی رییازیکی گشتگیر ده‌کات که یاسادانان له‌خۆبگرتیت که ده‌ستپێشخه‌رییه سه‌وزه‌کان هان بدات.

بۆ دا‌بین‌کردنی پێداویستی‌ه‌کانی بیناسازی عێراق ده‌ستبه‌جێ هه‌یه‌تی و له‌ داها‌تو‌دا ولات پیویستی به‌ به‌کاره‌ینانی ته‌کنیکه‌کانی بیناسازی به‌رده‌وامی هه‌یه له‌ هه‌موو کاره نه‌ندازیارییه‌کانیدا. به‌م شیوه‌یه ولات ده‌توانیت رینگا بۆ داها‌تو‌ویه‌ک دروست بکات که به‌هیزتر بیت تانه‌و شوینه‌ی که په‌یوه‌ندی به‌گه‌شه‌پێدان له‌ شارستانییه‌ت و گرنه‌گیدان به‌ نیکۆلوژی هه‌یه له‌ پله‌ی یه‌که‌مدا. یه‌کخستنی رییازه‌کانی به‌رده‌وامی له‌ بیناسازی نه‌ک ته‌نها یارمه‌تیده‌ره بۆ پاراستنی ژینگه به‌لکو په‌یکه‌ری کۆمه‌لایه‌تی و سه‌قامگیری نابووری پیکه‌ته‌کانی ناوچه‌کانی عێراق به‌رز ده‌کاته‌وه (Shawkat et al., 2023). سه‌ره‌رای پاشه‌کشه‌کان، نه‌م رییازه گرنه‌گه چونکه رییازیکی گشتگیر به‌ره‌و گه‌شه‌سه‌ندنی، بینین ' به‌رجه‌سته ده‌کات.

نموونه‌ی تو‌یژینه‌وه‌ی به‌رده‌وامی له‌ عێراقدا

هه‌ریمی کوردستانی کۆماری عێراق خاوه‌نی پێشه‌سازی بیناسازییه به‌هه‌ای نزیکه‌ی 2.8 ملیار دۆلار سامانی پاک به‌ بری مه‌زه‌نده‌کردنی 2500 به‌لێنده‌ر، ژماره‌کان ته‌نها له‌ به‌رزبوونه‌وه‌دان به‌هۆی نه‌وه‌ی نرخ‌ی سووته‌مه‌نی و کار و که‌رسته‌ی بیناسازی به‌رده‌وام خیراتر ده‌بیت (Shawkat et al., 2018). هه‌ریم به‌ بو‌ورانه‌وه‌یه‌کدا تیده‌په‌ریت له‌ گه‌شه‌کردن و گه‌شه‌کردندا له‌ نزیکه‌ی هه‌موو که‌رت و پێشه‌سازییه‌کان، له‌گه‌ل نه‌وه‌شدا به‌هۆی جیا‌و‌زییه‌کی قوول له‌ دیمۆگرافیای نابووری کۆمه‌لایه‌تی و خراب به‌ریوه‌بردن به‌ناوی حکومه‌تی خۆجیی، وا دیاره عێراق به‌ کیشه‌ی نیشته‌جی‌بو‌وندا تیده‌په‌ریت (فه‌رح، ی. ، ۲۰۱۴). ستاندارده‌کانی به‌رده‌وامی بۆ کاره‌کانی بیناسازی وه‌ک زنجیره‌یه‌ک په‌رسیار دارێژراون که ده‌بیت له‌لایه‌ن به‌ریوه‌به‌رانی پرۆژه‌که‌وه وه‌لام بدرینه‌وه. بنه‌ماکانی بیناسازی بینا بابه‌تی نه‌م لیکۆلینه‌وه‌یانه. لیستی پشکنینه‌که گرنه‌گی هه‌ر په‌رسیاریک له‌به‌رچاوه‌گرتیت سه‌باره‌ت به‌ پێوه‌ره‌کانی به‌رده‌وامی (Al-Nu'man & Ahmed, 2018). نه‌مه‌د و نه‌لنعمان کۆمه‌لێک پێوه‌ری به‌رده‌وامییان به‌کاره‌ینا له‌ شیوه‌ی نه‌و په‌رسیارانه‌ی که ناراسته‌ی نه‌ندازیاران و به‌ریوه‌به‌رانی پرۆژه‌کان کرا بۆ هه‌لسه‌نگاندنی 22 پرۆژه‌ی بیناسازی له‌ شاری هه‌ولێر/ هه‌ریمی کوردستانی عێراق. بۆ بریاردان له‌سه‌ر

چۆنیه‌تی جیبه‌جیکردنی ستاندارده‌کانی به‌رده‌وامیی، نه‌نجامه‌کان شیکرانه‌وه. پرسیاره‌کانی ناو لیستی پشکنینه‌که هه‌نگاه‌کانی بیناسازی و هه‌روه‌ها گۆراوه نابووری، کۆمه‌لایه‌تی و ژینگه‌یی‌ه‌کانیان هه‌لسه‌نگاند. دهره‌نجامه‌کان پشتگیری له سوودی لیستی پشکنینی پیتشیار کراو ده‌که‌ن بۆ حیسابکردنی هه‌لسه‌نگاندنی به‌رده‌وامیی بۆ پرۆژه‌کانی بیناسازی. به‌تیکرا نمره‌ی نزیکه‌ی 54% بۆ جیبه‌جیکردنی ریوشوینی به‌رده‌وامیی به‌ده‌ست هاتوو. دۆزینه‌وه‌کان نایه‌کسانییه‌کی به‌رچاو له به‌کاره‌ینانی ستاندارده‌کانی به‌رده‌وامیدا له سه‌رانسه‌ری هه‌موو پرۆسه‌ی بیناسازی جۆراوجۆری پرۆژه‌کانی بیناسازیدا ناشکرا ده‌که‌ن. نه‌بوونی یان بیکاریگه‌ری ریسا پابه‌ندکه‌ره‌کان، نه‌بوونی مه‌رجه‌کانی به‌رده‌وامیی وه‌ک بابه‌تیک له مه‌نه‌ه‌جه‌کاندا بۆ نه‌ندازیاری شارستانی، و په‌سه‌ندنه‌کردنی دیزاینه‌ گشتگیره‌کان که له‌سه‌ر پایه‌کانی به‌رده‌وامیی بنیات نراون هۆکاره‌کان (Al-Nu'man & Ahmed, 2018). هه‌روه‌ها هه‌ولئێ ناوخویی هه‌بووه، وه‌ک له تویژینه‌وه‌یه‌که‌دا دهرکه‌وتوو، تۆزی شووشه‌ که به‌ پاشماوه‌ی بیناسازی داده‌نریت وه‌ک جینگه‌ری خاک به‌ ریزه‌ی جیاواز تاقیکرایه‌وه و دهرکه‌وت له هه‌ولئیر سه‌رکه‌وتوو بووه (نیبراهیم و هاوکارانی، 2021). هه‌روه‌ها لیکۆلینه‌وه‌کان له به‌خدا دهریانخستوووه که پراکتیزه و که‌ره‌سته‌ی نوویی خشتکردن که کاریگه‌ری نه‌رینی له‌سه‌ر به‌هیزی و نه‌دای پیکهاته‌کانی بیناسازی نییه وه‌ک به‌کاره‌ینانی خشتی بۆ کون به‌ پیچه‌وانه‌ی خشتی کوندار، توانای که‌مه‌کردنه‌وه‌ی ریزه‌ی پاشماوه‌ی بینا و پاشماوه‌ی بیناسازی هه‌یه به‌ نزیکه‌ی 62% (خه‌روفا، 2007). جگه له‌وه‌ش، بروا عمر تویژینه‌وه‌یه‌کی له‌سه‌ر کاریگه‌رییه‌کانی تۆزی شووشه‌ی پاشماوه وه‌ک جینگه‌وه‌ی چیمه‌نتۆ له‌سه‌ر نه‌دای میکانیکی و پیکهاته‌یی له‌ کۆنکریتی به‌هیزکراودا نه‌نجامداوه به‌ تاقیکردنه‌وه‌ی تا 20% گۆرینی چیمه‌نتۆ به‌ تۆزی شووشه‌ی پاشماوه بۆ فشار و په‌ستایی-فشار، توندی، و مۆدیولی لاستیکی له 28 رۆژ و 180 رۆژدا، جگه له تاقیکردنه‌وه‌ی ریزه‌ی ناو بۆ به‌سته‌ر. هه‌موو نه‌مانه له هه‌ولئیکدا بوون بۆ پائانی به‌کاره‌ینانی سنووردارکراوی پیتشتر له تۆزی شووشه‌ی پاشماوه وه‌ک ماده‌ی جینگه‌وه‌ی چیمه‌نتۆ. له کۆتاییدا، تویژینه‌وه‌که نه‌نجامه‌ ئه‌رینییه‌کانی به‌ده‌سته‌ینا، که سه‌لماندی که نه‌گه‌ری به‌کاره‌ینانی تۆزی شووشه‌ی پاشماوه وه‌ک جینگه‌وه‌ی چیمه‌نتۆ (Omer, B., 2021). به‌داخه‌وه هه‌رچه‌نده هه‌ولئێ به‌ره‌وپیتشبردنی که‌رتی بیناسازی له عیراق هه‌بووه، هه‌روه‌ها هه‌ولئیش هه‌بووه بۆ نه‌وه‌ی زیاتر دۆستی ژینگه‌یی و که‌متر به‌فیرۆده‌ر بیت، به‌لام هیچ ستاندارد و ریسایه‌ک بۆ فریدانی پاشماوه‌ی بیناسازی له‌سه‌ر ناستی حکومه‌ت نییه، و به‌لئنده‌ران و سه‌ندیکاکانی نه‌ندازیارانی عیراقیش هیشتا هیچ شتیکیان له‌باره‌ی نه‌و بابه‌ته نه‌هیناوه‌ته‌ پیتشه‌وه (عوبه‌ید و هاوکارانی، 2019). له‌م نیوه‌نده‌دا، عیراق سالانه زیاتر له 100 ملیۆن تۆن پاشماوه‌ی بیناسازی به‌ره‌م ده‌هینیت، و زۆر سه‌لامه‌ته بلین نه‌گه‌ر نه‌مه به‌بۆ کۆنترۆل به‌رده‌وام بیت، ژماره‌کان به‌ دلنیا‌یه‌وه به‌رز ده‌بنه‌وه (Khaleel & Al-Zubaidy, 2018). نه‌م بیده‌نگییه به‌ناوی حکومه‌ت و ده‌سه‌لاتدارانی تره‌وه له‌سه‌ر نه‌و بابه‌ته‌ گه‌رفتیکی گه‌وره‌ی به‌ نۆره دروستکردوو، ملیۆنان تۆن پاشماوه‌ی بیناسازی له هه‌ردوو زبڵخانه‌ی دیاریکراو و نایاساییدا کۆبوونه‌ته‌وه به‌دریژیی سالان، که ده‌بیت له داها‌توودا به هه‌ر شیوه‌یه‌ک بیت کۆبکریته‌وه (نه‌حمه‌د، و.ه.، 2017). له کۆتاییدا لیکۆلینه‌وه‌م کرد له‌سه‌ر به‌کاره‌ینانی شله‌ی پۆلا وه‌کو کۆکراوه‌یه‌کی درشت یان ورد (چه‌و یان لم) له کۆنکریتدا و به‌ردی قسل وه‌ک جینگه‌وه‌ی چیمه‌نتۆ. نه‌نجامه‌کان دهریده‌خه‌ن که ریزه‌یه‌کی باشتر له شله‌ی پۆلا جینگه‌وه‌ی بۆ کۆکراوه‌ی درشت یان ورد تا 40% بووه بۆ هیزی په‌ستانی کۆنکریته‌که به‌ ده‌ست هاتوه.

Sustainable construction materials and challenges of sustainability in Iraq

Introduction:

The building sector is one of the biggest causes of environmental degradation, mainly due to its resource consumption and waste production. Sustainability is becoming more and more embraced, especially in reconstruction-intensive locations like Iraq, there is an increasing demand for sustainable construction methods. Apart from minimizing adverse impact on the environment, sustainable construction impact positively on social justice and economic feasibility in the living space (Mahjoob et al., 2023). The use of advantageous innovative technologies and green materials to be explored in Iraqi building on many sustainability-related themes in this essay. The discussion begins with analyzing the importance of sustainable practices to reduce pollution and support resource efficiency. It then surveys the range of eco-friendly construction materials available, indicating how they might disrupt conventional practices. Nevertheless, despite these advantages, legal issues and limitations to infrastructure make it extremely difficult for Iraq to adopt sustainable practices (Majeed, 2023).

The essay will also examine government regulations that assist green building initiatives and (1) how modern technologies might support sustainable construction approaches. Finally, it will include case studies of successful sustainable projects in Iraq, showing how these ideas can be used practically in everyday situations. This essay's focus is on the significance of sustainability in addressing the challenges and advancing the prospects for Iraq's construction sector (2) by providing a detailed analysis of these issues. And there is a great hope for such progress, for instance, there are many opportunities for development. However, it is fair to point out that (3) a number of issues, such as financial limitations and regulatory obstacles, may impede such improvements. Creative approaches, then, should be integrated as much as possible.

Significance of Sustainable Construction Practices:

Sustainable building practices are all the more vital in a context like Iraq where rehabilitation is urgently required, one cannot speak of their significance with less emphasis. Sustainable construction includes practices which curb negative environmental impacts while providing social and economic benefits. As a result of Iraq's current standing in environmental performance index, the construction sector may reduce waste generation and resource utilization significantly by adopting these methods (Mahjoob et al., 2023). While further enhancing communities' quality of life, sustainable measures also address ecological concerns and thereby ensure safer and healthier living conditions.

In addition, sustainable construction strengthens economic resiliency through improving resource use and gradually reducing maintenance costs. By employing energy-efficient designs (and materials), stakeholders are able to spend less on utilities and lengthen the life of the buildings (Majeed, 2023). Iraq needs this economic viability in order to restore its infrastructure following years of war. Additionally, integrating social aspects into sustainable practices encourages local involvement in construction projects and fosters equity within communities by generating employment opportunities in green technologies. The shift to environmentally friendly building practices is also in line with worldwide movements that prioritize reducing the effects of climate change. The world is grappling with a crisis in the environment but for countries such as Iraq which are no doubt vulnerable to certain elements brought about by climate change, embracing sustainable practices is paramount. In the same context, alerting relevant parties on the sustained benefits of sustainability is important too. More importantly, this transformation or alteration calls for an all-rounded approach that includes legislation that stimulates green initiatives.

To meet the construction requirements Iraq has immediately and in the future the country needs to employ sustainable building techniques in all its engineering works. This is how the country can create pathways for a future that is more robust in as far as development in civilization and care for the ecology is concerned in the first place. Integrating the approaches to sustainability into constructions does not only help to protect the environment but enhances the social fabric and stability of the economies of the communities in the Iraqi regions (Shawkat et al., 2023). In

spite of the setbacks, this approach is critical because it embodies a holistic approach towards 'seeing' development.

Eco-Friendly Materials in Building Projects:

One of the most critical areas in sustainable construction is using environment friendly materials in the case of constructions, and more primarily, due to the acute reconstruction issues being faced by Iraq. For example, eco-effective building materials are usually derived from renewable sources or designed to minimize their lifetime environmental impacts which in turn helps reduce the construction waste and pollution associated with construction activities. Such materials are bamboo, reclaimed wood, recycled steel, other substitutes for concrete that all minimize the carbon emissions without compromising with the quality of the structures (Mahjoob et al., 2023). The challenge however rests in how to balance the cost of these materials with their sufficient supply. And even though they have a myriad of benefits, they might be refractory to some architects (and builders) due to some ensuing disadvantages. This reticence could be due to the failure to perceive or understand the actual long-term benefits the materials bring.

In addition, such materials and constructions address the most acute environmental issues and promotes energy efficiency in buildings. Applying the green insulation materials, for example, helps to enhance thermal efficiency of a building and thus reduce the energy loads for heating and cooling (Majeed, 2023).

Implementing these country's eco-friendly solutions could significantly improve air quality in urban areas with elevated pollution levels and advance broader sustainability goals by promoting healthier living conditions. There's still a knowledge gap among building industry players with respect to the benefits of these materials. Sustainable construction material legislation is also yet to be widespread (Shawkat et al., 2023). However, enabling regulation is lacking so the contractors' intent to opt for more sustainable options remains unfulfilled due to the sense of higher initial investment for sustainable ones that may lead to better long-run benefits.

Moreover, the application of environmentally sustainable materials for building projects could be influenced by domestic (and) supply chain factors. Many current innovative sustainability products may not be easily available on Iraq's market, because of this, relying on imported products could create logistical challenges and increase the total cost of projects. Implementing these country's eco-friendly solutions could significantly improve air quality in urban areas with elevated pollution levels and advance broader sustainability goals by promoting healthier living conditions. Implementing these countries' environmentally friendly solutions, on the other hand, has the potential to make a difference in the air quality of metropolitan places where pollution levels are often high, and contributes to broader sustainability objectives by facilitating healthier living conditions.

Challenges Of Sustainability in Iraq:

The path towards incorporating environmentally friendly practices in the construction industry in Iraq faces several challenges in its move for sustainability. One major challenge is the absence in most developing nations of a comprehensive legal framework that promotes construction activities that meet sustainability requirements. The present rules do not force the provision of sustainable practices or management of stakeholders and contractors and thus, the practices and involvement of stakeholders and contractors are not compulsory and are still minimal (Mahjoob et al, 2023). Not only this regulatory gap but also this gap contributes to the perception that sustainable materials and practices are costly while they can provide cost savings in the long run. Furthermore, the significant daily waste output from construction activities—estimated at 4.9–8% of GDP—exacerbates Iraq's dangerously low environmental performance ranking (Mahjoob et al.,). The current infrastructure is ill-equipped to manage garbage efficiently, which increases pollution and depletes resources. As a result, the incorporation of sustainable practices becomes even more crucial, albeit more complicated (in this context).

Besides the challenges that come with the regulations and structures, socio-economic factors also pose a great challenge to sustainability initiatives. This is because many of the stakeholders (in the construction industry) have insufficient understanding on what may be considered sustainable approaches and materials since there are no adequate educational resources or training programs that concentrate on green building concepts (Shawkat et al., 2023). As a result of this

knowledge gap, industry players may oppose change and are still focusing on the immediate financial return rather than the long term sustainable goals. Also, the reconstruction efforts in Iraq are still being challenged by several challenges including political instability. Policies and measures that are put in place to ensure sustainable development can be derailed by the frequent changes in government as in the case of Iraq (Majeed, 2023). This uncertainty deters both domestic and international investors from allocating funds required to promote environmentally friendly building projects; yet, this circumstance might be lessened with the implementation of focused educational campaigns.

These complex and multidimensional problems should be addressed jointly by government bodies with corporate executives and civil society organizations. It is however very important that stakeholders' participation in collaborative techniques contributes to the formulation of strong policies and the academic climate of innovation and education on sustainable building technologies. This is important since even though some voices might be disregarded, it still makes sure that voices from every corner are represented.

Innovative Technologies for Sustainable Construction:

In the nations where power management and construction are vital, for instance Iraq, the inception of new innovative technologies in the development of a sustainable built environment is crucial. Apart from enhancing the building process and effectiveness of constructing building, these technologies extend the effects of environmental degradation as experienced under the conventional techniques of construction. For instance, Building Information Modeling (BIM) have turned into one of the essential strategic tools to enhance construction practice in minimizing resource usage and optimization throughout the construction life cycle. By using BIM in positioning and planning buildings before construction begins, any waste in the processes can be identified, leading to improved sustainable development of projects (Habib & Erzajj, 2023).

A technique that has shown some potential for use is that of prefabrication whereby constructions are partly or wholly assembled off site under environmentally suited conditions and then hauled to the site. Through the usage of less energy during construction of these materials the process also helps in minimizing wastage.

Future prefabricated structures can be even ‘greener’ through increasing the utilization of environment friendly materials to further reduce their burdens on the environment (Majeed, 2023). As with any construction method, modular construction also brings benefits to resource efficiency and design variability and adaptability. Efforts towards sustainable building also greatly embrace renewable energy technologies. Solar panels or wind turbines fixed at building construction can improve energy use and give buildings that are energy independent or capable of generating their power. Such development contributes towards attaining the global sustainability objectives by reducing the emission of greenhouse gases as well as use of fossil energy.

In addition, it has been seen that IoT sensors integrated into smart building technologies makes it possible to monitor and control building energy usage in near real-time. The fact that these systems have the ability to change the lights, heat, ventilation, and other working parameters depending on the occupancy rates and the climate of the surrounding environment improves efficiency greatly on the overall systems (Shawkat et al., 2023). Technology does play an important role in the enhancement of the ideas involving sustainable building in Iraq because it helps to manage resources and minimize adverse impacts. All of these technologies are at the moment only beginning to enter the mainstream within the context of the regional market, but their potential is massive to steer the construction industry of Iraq into a more sustainable direction. However, challenges remain.

Government Policies Supporting Green Building:

It is therefore important for government to make policies that support the use of green building techniques to reduce the impacts that building industry has on the environment especially in areas like Iraq. The problem of legal frameworks that facilitate sustainable construction activities has emerged more and more in the recent past. Although this fosters a transition toward environmentally sustainable processes and practices in the business, good policies should provide measures that can encourage the use of sustainable products and technology (Mahjoob et al., 2023).

Lack commitment and policies that which encourage and compel sustainable practices in construction is one of the biggest challenges facing Iraq. To fill this gap, it is necessary that policymakers prioritise the development of well-defined and enforceable codes which support sustainable action. At the moment, there is

often no guideline for green building standards and where they do exist, they are often not properly followed. Usually contractors avoid using environmentally friendly products because it is believed that they are more costly. Some of these policies can be in form of grants to firms in green technology innovation, plus extending tax incentives to firms undertaking low energy designs or employing environmentally friendly products.

Besides, governmental campaigns promoting sustainable activities can also educate those parties willing, in the feasibility of harnessing sustainable constructing techniques. To enhance more suburb industry personnel's knowledge and to support the formation of a sustainable culture, authorities should curtail training programs concerning green building approaches and products. For fostering an environment that could accommodate innovation and investment in sustainable buildings, the collective effort of all industry stakeholders is, therefore, mandatory. Interactions with international groups for sustainable development can also be beneficial; this is because there may be access to knowledge and state-of-the-art technology for development suitable for the area that has been developed by the international bodies. Thus, Iraq can build itself as a country striving to become an example of environmentally friendly construction practices by aligning them with goals stipulated on the international level.

To eliminate challenges to sustainable construction in Iraq, there is a need for strong governmental measures supporting green construction. Despite the fact that politicians can address the nation's pressing environmental issues, the latter can set up a conducive environment with efficient regulation of behaviors, education and partnership in environmental management (Habib & Erzajj, 2023).

Examples of Sustainable Projects in Iraq:

There have recently been several examples of sustainable building practices in Iraq and there is a growing commitment evidenced by this emerging area of development despite the numerous challenges posed by the reconstruction of this country. One such initiative includes the Green Building of the city of Erbil which through the implementation of high technologies and locally supplied materials intends to create energy-saving structures. Although this project indicates that incorporating creative designs in buildings can greatly reduce resource use while at the same time enhancing building lifetime benefits by supporting the use of solar

power for electricity production or integrating rainwater harvesting systems. (Shawkat & colleagues, 2023)

An example of a project of this kind is the reconstruction of the historic districts in Baghdad for sustainable development. The purpose of this project is to save old buildings and bring them back into use and use modern, new sustainable materials. Besides strengthening the cultural identity of societies, these renovations improve the effectiveness of energy use of old structures such as thermal insulation and natural ventilation (Majeed, 2023). Such innovations give references for further ones, illustrating how sustainability and preservation of heritage might be achieved. In this region, projects also illustrate how the community engages in sustainable construction. Realizing that the potential benefits of green building need to be explained to stakeholders, local governments began to fund awareness initiatives. According to Mahjoob et al. (2023), these initiatives are crucial for encouraging a sustainable culture among both homeowners and builders. Although it has less environmental impact, using local resources in construction processes promotes economic resilience much more.

Furthermore, many pilot projects that concentrate on affordable housing options use sustainable materials such as recycled plastics and compressed earth bricks. These programs meet the adequate need for shelters, and segregation and address rightly a compelling need with the proportionate accentuation on sustainable construction as deemed affordable with presumptive sustainable developable parts, and sustainable and (Habib & Erzaij, 2023). Altogether, it emerged that there are rising tendencies of a shift towards sustainable construction in Iraq although there are certain barriers like weakness of legal requirements and scarcity of first-hand knowledge. The successful completion of these projects calls for the cooperation of local communities, industry players, and government organizations in fostering an environment that rewards innovative efforts aimed at ecological sustainability and economic growth. However, this development is not without considerable effort; this is because stakeholders have to work hard to navigate through a complex environment as a result of complexity. These efforts are important for future housing solutions because the process is not easy, however the potential benefits are great.

Examples of Sustainable research in Iraq

Kurdistan region of the Republic of Iraq has a construction industry worth about 2.8 billion dollars in net worth with an estimated amount of 2500 contractors, and the numbers are only rising as the prices of fuel, labor and construction material are constantly accelerating (Shawkat et al., 2018). The Region is going through a boom in growth and development in nearly all sectors and industries, yet due to a deep contrast in socioeconomic demographic and mismanagement on behalf of the local government, it seems that Iraq is going through housing problems (Faraj, Y., 2014). The sustainability standards for construction works are laid out as a series of questions that must be answered by the project managers. The fundamentals of building construction are the subject of these inquiries. The checklist takes into account the importance of each question in regards to the sustainability criteria (Al-Nu'man & Ahmed, 2018). Ahmed and Al-Nu'man used a set of sustainability criteria in the form of questions posed to the engineers and project managers to evaluate 22 construction projects in the city of Erbil/Kurdistan region of Iraq. To decide how to execute the sustainability standards, the results were analyzed. The questions on the checklist weighed construction steps as well as economic, social, and environmental variables. The outcomes support the usefulness of the suggested checklist for calculating a sustainability rating for building projects. A score of about 54% was obtained on average for applying the sustainability measures. The findings reveal significant heterogeneity in the application of sustainability standards throughout all of the building projects' various construction processes. The lack of or ineffectiveness of binding regulations, the absence of sustainability requirements as a subject in curricula for civil engineering, and the lack of adoption of comprehensive designs built on the pillars of sustainability are the causes (Al-Nu'man & Ahmed, 2018). There have also been local efforts, as one study showed, glass powder, which is considered to be construction waste was tested as a soil stabilizer in different percentages and it was found to be successful in Erbil (Ibrahim et al., 2021). Studies in Baghdad have also shown that new bricking practices and materials that do not negatively affect the strength and performance of building structures such as using solid bricks as opposed to perforated bricks have the potential of reducing the amount of building debris and construction waste by almost 62% (Kharrufa, 2007). Furthermore, Omer B. has performed a study on the effects of waste glass powder as a replacement of cement on the mechanical and structural performance in reinforced concrete by testing up to 20% cement replacement by waste glass powder for compressive stress-strain, toughness, and elastic modulus at

28 days and 180 days, in addition to testing the water-to-binder ratio. All of which were done in an effort to push the previously limited use of waste glass powder as a cement replacement material. Finally, the study yielded positive results, proving the feasibility of using waste glass powder as a cement replacement (Omer, B., 2021). Unfortunately, even though there have been efforts towards improving the construction sector in Iraq, and there have also been efforts towards making it more eco-friendly and less wasteful, there is no standard or regulation for the disposal of construction waste on a government level, and the contractors and engineer unions of Iraq have yet to come forward with anything about the subject either (Obaid et al., 2019). Meanwhile, Iraq keeps generating over 100 million tons of construction waste annually, and it is pretty safe to say that if this goes on unchecked, the numbers are bound to rise (Khaleel & Al-Zubaidy, 2018). This silence on behalf of the government and other authorities on the matter has caused a big problem in turn, millions of tons of construction waste have gathered up in both designated and illegal landfills over the years, which has to be collected in the future anyway (Ahmod, W. A., 2017). Finally, I researched using steel slag as a coarse or fine aggregate (gravel or sand) in concrete and limestone as a replacement for cement. the results show that a better percentage of replacement steel slag for coarse or fine aggregate was until 40% for the compressive strength of the concrete.

Conclusion:

In conclusion, a study of developing and implementing green construction in Iraq revealed a lot of opportunities and challenges at the same time. That is why the ability of sustainable construction methods of reducing environmental impacts together with enhancing social justice and economic vulnerability proves the significance of these concepts. Sustainable products offer a radical approach to reduced waste and consumption of energy, but the industry participants are unaware of the scheme or the requirements to adapt to it and the legislation is ineffective as well. Technologies (like prefabrication and building information modeling) are strategic tools which play an important role in influencing productivity and impact on the natural environment in building projects. But if there are no imposing government regulations that are instrumental to the exercise of sustainable building then the transition will still be slow. The bureaucratic issues of the Iraqi building projects were illustrated in the case studies as being

complicated by obstacles; but the industry appears to be moving in the direction of using environmentally sustainable practices more often.

These examples not only highlight successful examples but also unveil how critical and necessary involving of local communities, top-managers, and government institutions in achieving sustainable development goals is. Instead, collective measures must be taken to continue working on the closure of the loopholes within the legislation factor and improving the teaching aids related to sustainable practices as well as developing the kind of environment that might foster innovation if Iraq needs to fulfill the reconstruction goals alongside the sustainable norms and standards as acknowledged internationally. Iraq may offer an example of designing the long-term policy of a post-warring, the priority is given to sustainable construction now (because of this).

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